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The Status of Required Physical Education in Colleges and Universities of the United States

By John H. Shaw
and
Millard R. Rogers
Syracuse University
Syracuse, New York

(Submitted for publication September, 1945)

THE war has had a profound effect on the physical education programs of our colleges and universities. Studies by Jones,[1] Webster,[2] Greene,[3] and at Indiana University[4] all reflect greater recognition of physical education as a regular part of the college program.

The selective service figures on the health of our men have been exceedingly discouraging. As a result, much has been written about the failure of health and physical education programs in the schools. The question might well be asked, "How can students be expected to consider the courses in these areas important if they are not given credit on an equal basis with other subjects?"

Even in colleges where increased credit and time allotments have been granted, physical education is still regarded in many cases as an extra credit course, and not as the equivalent of other college subjects carrying a similar amount of credit. This discrimination has been evidenced by offering plus credit (120 + physical education), by wholesale excuses from the requirement, or by failure to count physical education grades in figuring honors either by semesters or at graduation.

The following survey was undertaken to secure data on the present status of physical education in the colleges and universities of the country. Replies indicated that its status in the college program was under consideration in many of the cooperating schools.

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1 Lloyd M. Jones, "Recent Changes in the Requirement and Content of Required Health and Physical Education for Men in Land Grant Colleges and Universities," *Research Quarterly*, 13:3 (October, 1942), pp. 364-72.

2 Randolph Webster, "A Survey of Physical Education Requirements for Graduation," *Journal of Health and Physical Education*, 16:4 (April, 1945). pp. 174, 214-218.

3 Margaret Duncan Greene, "Survey of the Requirement and Credit in Physical Education in Colleges and Universities as of Fall Term, 1944," *Research Quarterly* 16:2 (May, 1945), pp. 120-127.

4 Unpublished study by Indiana University Department of Physical Education for Men, June, 1945.

STATEMENT OF PROBLEM

The purposes of the inquiry were:

1. To determine the physical education requirement in the colleges and universities of the country.

2. To discover to what extent grades in physical education were counted in figuring honors by semesters and at graduation.

3. To discover present practices in excusing students from physical education requirements.

Although the studies listed above had in each case investigated the first purpose listed, it was felt necessary to include it in order to interpret other questions satisfactorily.

The following explanatory statement and questionnaire was sent to 352 directors of physical education in colleges and universities in the United States. A double postcard form was used to encourage response.

Dear Colleague:

The status of physical education is under discussion on our campus. Some of the questions involved are: What should be the nature of the requirement, and, if credit is granted, should it count the same as for any other subject?

A survey of present practices will help immeasurably in solving our problem. We would greatly appreciate your filling out and mailing the attached card. Any comments you might have would also be appreciated. The results of this study will be made available when it is completed.

Sincerely yours,

JOHN H. SHAW,
Department of Physical Education
Syracuse University

How many semesters of physical education are required for graduation at your school? Total———
No. of required semesters carrying credit. ———
No. of semesters not carrying credit. ———
Do physical education grades count in figuring honors by semesters? (underline correct response) Yes No
Do grades in physical education count toward honors at graduation (e.g. cum laude, etc.) Yes No
If a student is excused from physical education by the school physician, he: (underline correct response)
Is excused from the requirement.
Has to take equivalent hours in other subjects.

(If neither is correct write in correct response on line above.)
Comments: .....
Signature .....
School .....

A total of 246 replies was received, approximately a 70% return. As cards were addressed to the director of physical education, results probably more nearly represent practices in regard to the men's program than the women's. However, in certain cases information was volunteered that the girls' requirement differed slightly. This difference was usually in the direction of a slightly lower time

requirement. The war undoubtedly stimulated the expansion of the program for men. There are 29 women's colleges included in the study, and the summary of these results gives a certain basis for comparing the program for the two sexes.

FINDINGS AND DISCUSSION

The schools from which returns were received fall into five major classifications:

	Total Answering Questionnaire
Universities (state controlled)	42
Universities (privately controlled)	46
Colleges (state controlled)	39
Colleges (privately controlled)	74
Teachers Colleges (state controlled)	45
Grand Total	246

In summarizing, the data has been classified in terms of co-educational, men's and women's schools, as well as in the five categories listed above. This was done in order to compare the practices in these types of institutions.

SUMMARY OF QUESTION I

How many semesters of physical education are required for graduation at your school?

	Total Replies		*Semesters Required**								*Unclassified*	*No Answer*
		0	1	2	3	4	5	6	7	8		
Universities, Private	46 N	1	0	7		16		2		11	5	4
	%	2.17		15.21		34.78		4.35		23.91	10.9	8.7
Universities, State	42 N	3		9		22			1	7		
	%	7.14		21.42		52.37			2.38	16.66		
Colleges, Private	74 N	6		5		28	3	14		18		
	%	8.11		6.76		37.83	4.05	18.91		24.32		
Colleges, State	39 N	1**		4		19	1	6		8		
	%	2.56		10.26		48.71	2.56	15.38		20.51		
Teachers Colleges, State	45 N		1	4	0	17	2	9	5	7		
	%		2.22	8.89		37.78	4.44	19.99	11.11	15.55		
Coed Schools	185 N	8	1	26	0	80	3	22	5	33	5	2
	%	4.32	.54	14.1		43.24	1.62	11.9	2.7	17.83	2.7	1.1
Women's	N	1		1		12	1	6		8		

* In all cases where institutions reported requirements by quarters, these have been transposed to semesters to simplify the tables, *e.g.*, 3 quarters equal 2 semesters.

** In one college all students take ROTC, except the physically handicapped, who take corrective gym.

Schools	29	%	3.45		3.45		41.38	3.45	20.69		27.58	
Men's		N	1		4		11	1	3	1	11	
Schools	32	%	3.13		12.5		34.37	3.13	9.38	3.13	34.37	

SUMMARY OF QUESTION 1A

NUMBER OF REQUIRED SEMESTERS CARRYING CREDIT

		Total Replies	Semesters With Credit								Unclassified	No Answer
			0*	1	2	3	4	5	6	7	8	
Universities, Private	N	46	14		3		19		2		4	4
	%		30.4		6.5		41.3		4.3		8.6	8.6
Universities, State	N	39	5		8		15				5	6
	%		12.8		20.5		38.4				12.8	15.3
Colleges Private	N	72	28		5		16	2	7		12	2
	%		38.8		6.9		22.2	2.8	9.7		16.7	2.8
Colleges State	N	38	4		4		17	1	5		7	
	%		10.5		10.5		44.7	2.6	13.2		18.4	
Teachers' Colleges State	N	45	9	1	5		14	2	11		3	
	%		20	2.2	11.1		31.1	4.4	24.4		6.7	
Coed Schools	N	179	38	1	24	1	64	4	18		24	2 3
	%		21.2	.6	13.4	.6	35.7	2.8	10		13.4	1.1 1.7
Women's Schools	N	29	12		1		7		4		4	1
	%		41.4		3.4		24.1		13.8		13.8	3.4
Men's Schools	N	32	12		1	1	6	1	2		4	2 3
	%		37.5		3.1	3.1	18.7	3.1	6.3		12.5	6.3 9.4

* Number of schools where none of the required semesters carry credit.

SUMMARY OF QUESTION 1B

NUMBER OF REQUIRED SEMESTERS NOT CARRYING CREDIT

		Total Replies	Semesters Without Credit								Unclassified	No Answer
			0*	1	2	3	4	5	6	7	8	
Universities, Private	N	46	20		6		7		2		6	2 3
	%		42.7		12.8		14.9		4.2		12.8	6.4
Universities, State	N	32	18		1	1	6		1		2	3
	%		56.3		3.1	3.1	18.7		3.1		6.3	9.4
Colleges Private	N	72	43				13	1	7	1	5	2
	%		59.7				18	1.4	9.7	1.4	6.9	2.8
Colleges	N	39	33				2		2		1	1

* Number of schools where all of the required semesters carry credit.

State Teachers' Colleges	%		84.6				5.1		5.1		2.6		2.6		
	N	45	27	5	3		6		1		3				
State	%		60	11.1	6.6		13.3		2.2		6.6				
Coed Schools	N	178	110	5	7		28		12	1	15				
	%		61.8	2.8	3.9		14.6		6.7	.6	8.4				
Women's Schools	N	29	17				5	1	1		4	1			
	%		58.6				13.8	3.4	3.4		17.2	3.4			
Men's Schools	N	27	14		3	1	2				5	2			
	%		51.8		11.1	3.7	7.4				18.5	7.4			

The above tables show that more state-controlled institutions grant academic credit for physical education than do private schools. Eighty-six percent of the state-controlled colleges and universities grant credit, while only sixty-five percent of the private institutions do likewise.

Similarly, more coeducational schools grant credit than do either men's or women's colleges and universities. Eighty-one percent of coeducational institutions grant credit as compared to sixty-three percent for men's schools and fifty-nine percent for girls' schools.

A general summary of all institutions indicates that sixty-nine percent of the schools grant full academic credit for each semester of required physical education. Thirteen, or five percent of the schools, give some credit, while twenty-four percent allow no credit at all.

SUMMARY OF QUESTION 2

Do physical education grades count in figuring honors by semester?

		Replies	*Yes*	*No*	*No Answer*
Universities, Private	N	46	15	31.	
	%		32.6	67.4	
Universities, State	N	42	24	16	2
	%		57.1	38.1	4.8
Colleges, Private	N	74	27	42	5
	%		36.5	56.7	6.8
Colleges, State	N	39	26	12	1
	%		66.7	30.7	2.6
Teachers' Colleges, State	N	45	27	18	
	%		60	40	
Coed Schools	N	185	100	79	6
	%		54.5	42.7	3.2
Women's Schools	N	29	11	16	2
	%		37.9	55.2	7
Men's Schools	N	32	8	24	
	%		25	75	

An analysis of the answers to Question 2 shows a major differ-

ence between state and private institutions in regard to the counting of physical education grades in computing honors by semesters. Sixty-three percent of the state-controlled schools count them, while only thirty-seven percent of the private colleges and universities use these grades in figuring honors by semesters.

Similarly, there were major differences between the coeducational schools and the men's and women's institutions. Fifty-six percent of the coeducational schools count physical education when computing honors by semester, while only thirty-nine percent of the women's and twenty-five percent of the men's schools count them.

Considering all replies, exactly fifty percent, or 119 schools, include physical education grades when computing honors by semester.

SUMMARY OF QUESTION 3

Do physical education grades count toward honors at graduation, e.g., cum laude, etc.?

		Replies	*Yes*	*No*	*No Answer*
Universities, Private	N	46	14	32	
	%		30.4	69.6	
Universities, State	N	42	25	15	2
	%		59.5	35.7	4.7
Colleges, Private	N	74	25	44	5
	%		33.8	59.4	6.7
Colleges, State	N	39	26	12	1
	%		66.7	30.8	2.6
Teachers' Colleges, State	N	45	26	19	
	%		57.8	42.2	
Coed Schools	N	185	98	81	6
	%		53	43.8	3.2
Women's Schools	N	29	10	17	2
	%		34.4	58.6	6.9
Men's Schools	N	32	8	24	
	%		25	75	

The results of Question 3 show practically the same relationships as does the summary of Question 2. Sixty-three percent of the state-controlled schools figure physical education grades when computing graduation honors, while only thirty-four percent of private institutions use these grades.

Likewise coeducational schools again lead the men's and women's schools in counting physical education grades when computing graduation honors. Fifty-five percent of the coeducational institutions count these grades, while only thirty-seven percent of the men's and twenty-five percent of the women's figure in physical education marks.

A surprising discovery was that in a few cases physical educa-

tion grades were not counted toward honors by semesters but were counted toward honors at graduation. This practice seems to be inconsistent.

SUMMARY OF QUESTION 4

*If a student is excused from physical education by the school physician, what happens?**

		Replies	Excused from Requirement	No Excuses Allowed	Takes Equivalent Work in Other subject Courses	Takes Restricted Course	Miscellaneous
Universities, Private	N	46	22	6	12		6
	%		47.8	13	26.1		13
Universities, State	N	42	22		13		7
	%		52.4		30.9		16.7
Colleges Private	N	74	30	3	13	21	7
	%		40.5	4.1	17.6	28.4	9.4
Colleges State	N	39	14		13	12	
	%		35.9		33.3	30.8	
Teachers' Colleges State	N	45	10	5	12	12	6
	%		22.2	11.1	26.6	26.6	13.3
Coed Schools	N	185**	75	15	57	49	10
	%		36.4	7.28	27.66	23.78	4.85
Women's Schools	N	29	10	1	3	15	
	%		34.5	3.4	10.3	51.7	
Men's Schools	N	32	19		3	7	3
	%		59.4		9.4	21.9	9.4

* The wording of the original question has been changed slightly in order to summarize adequately.

** In answering this question some gave two answers; therefore, this total is smaller than the total of the sub columns.

The practice in regard to excusing students from physical education requirements seems to be relatively uniform within the five groups studied, although differences do exist between individual institutions.

Approximately forty-one percent of the schools stated that students excused by the school physician were excused from the requirement, while twenty-six percent stated that students were required to take the equivalent in other subjects. Twenty-two percent required students to take restricted courses, while seven percent allowed no excuses. The remaining four percent included two percent, health courses, and two percent, miscellaneous.

An interesting inconsistency was evident in several cases where credit for physical education was not granted but when a student was excused from the requirement he was forced to take credit courses in its place.

SUMMARY AND CONCLUSION

1. The findings in this study in regard to the number of schools requiring physical education (96%) agree with Greene's study.[5] Approximately sixty percent of the schools had either a four- or eight-term requirement.

2. Sixty-nine percent of the schools grant full academic credit for each semester of required physical education; five percent give some credit; twenty-four percent give no credit.

3. Fifty percent of the schools count physical education grades when computing honors by semesters.

4. Forty-nine percent of the schools count physical education grades when figuring honors at graduation.

5. Private schools are much more conservative in granting credit and counting physical education grades toward honors both by semesters and at graduation than are state-controlled schools. This is probably due to state schools being more directly responsible to their constituencies. The same conclusion applies to men's and women's schools as compared to coeducational institutions.

6. Certain schools are inconsistent in their policies in regard to giving credit and honors for physical education.

7. There are no major differences between the groups of schools studied in regard to their practice of granting excuses from physical education.

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[5] Greene, *op. cit.*

Anthropometric Characteristics And Physical Fitness

By Carl C. Seltzer

From the Grant Study, Department of Hygiene
Harvard University, Cambridge, Massachusetts

(Submitted for publication December, 1945)

INTRODUCTION

IN THE use of the Step Test and Pack Test for assessing dynamic physical fitness, several considerations have arisen which necessitate additional analytical information.* Two of the main considerations are explored in this study. They are (1) the extent of the relation of a few pertinent anthropometric measures with dynamic physical fitness, and (2) the question of the necessity for making correction for variations in stature and leg length.

The data on which this study is based were derived from a group of somewhat more than 300 aviation cadets at a military training center in 1943, and from several groups of college students, principally freshmen at Harvard College. Medical and physical requirements employed in the selection of the aviation cadets served to eliminate certain physical types present in the general population. The group of college freshmen were unselected, with the exception of those who participated in the Treadmill Test.**

The analysis that follows is divided into several sections. The first part deals with Pack Test results obtained on the aviation cadets before and after training. The next section is concerned with the Step Test results on the same group of individuals, also before and

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*References to the more pertinent literature on these tests and for the definition of type of "dynamic physical fitness" measured are to be found in the following:

Johnson, R. E. and L. Brouha, "Pulse Rate, Blood Lactate, and Duration of Effort in Relation to Ability to Perform Strenuous Exercise," *Revue canadienne de Biologie*, 1:2 (Feb., 1942), pp. 171-178.

Johnson, R. E., L. Brouha, and R. C. Darling, "A Test of Physical Fitness for Strenuous Exertion," *Revue canadienne de Biologie*, 1:5 (June, 1942), pp. 491-503.

Brouha, L., A. Graybiel, and C. W. Heath, "The Step Test," *Revue canadienne de Biologie*, 2:1 (Feb., 1943), pp. 86-92.

Gallagher, J. R., and L. Brouha, "Dynamic Physical Fitness in Adolescence," *Yale Journal of Biology and Medicine*, 15:5 (May, 1943), pp. 657-783.

Brouha, L., N. W. Fradd, and B. M. Savage, "Studies in Physical Efficiency of College Students," *Research Quarterly*, 16:3 (Oct., 1944).

Gallagher, J. R., and L. Brouha, "Physical Fitness," *Journal of the American Medical Association*, (July 22, 1944), 125: 834-838.

**The Treadmill subjects were Grant Study participants. For a description of this group the reader is referred to *What People Are* by Clark W. Heath, et al., published by the Harvard University Press, 1945.

after a severe training period. The final section treats of the Treadmill, Step, and Pack Tests in the college students in varying states of physical conditioning.

PACK TEST

(Beginning of Training Period)

Physical Fitness Indices at the Beginning of Training Period.—Physical fitness scores were obtained for 306 cadets at the beginning of their training period by means of the Pack Test. The scores ranged from 34 to 101 with a mean of 73.35 for the whole group. This mean represents a "high average" state of physical efficiency for the group as a whole. The variability of the fitness scores for this series as evidenced by the standard deviation of 10.90 is not especially great. The form of the frequency distribution can be described as slightly asymmetrical, if one omits the artificial lumping of all the scores below 40. The actual frequency distribution for these physical fitness indices with their cumulative percentages is given below:

Physical Fitness Scores	*No.*	*Cumulative Percentage*
x - 39	7	2.3
40 - 44	3	3.3
45 - 49	4	4.6
50 - 54	9	7.5
55 - 59	8	10.1
60 - 64	10	13.4
65 - 69	30	23.2
70 - 74	72	46.7
75 - 79	90	76.1
80 - 84	42	89.8
85 - 89	24	97.6
90 - 94	4	98.9
95 - 99	1	99.2
100 - x	2	99.9
	306	

It must be remembered, in assessing the physical status of this group, that these individuals do not represent a random sample of the youth of the population at large but a rather highly selected contingent. Especially rigid selection was carried out medically with the elimination of all individuals with even slight medical "defects." In addition, by the time the boys had reached this stage of the training program, the great majority had already been subjected to varying degrees of physical conditioning.

Stature and Physical Fitness Indices.—Stature in this series of individuals varied from 160.2 cms. to 193.9 cms. This extensive

range in stature gives adequate scope for the study of relation of stature to physical fitness. When stature was correlated with the physical fitness scores at the beginning of the training period, it was found that there was a virtual absence of any relation between them. The coefficient of correlation computed by the Pearson product moment method was only 0.04. An examination of the scattergram for stature and physical fitness indices reveals that in spite of the coefficient of correlation figure of 0.04 there is a suggestion that the extremely short individuals with statures below 165 cms. (65 inches) exhibit a slight tendency to have rather low physical fitness scores. The 8 individuals in the series with statures below 165 cms. give an average score of 65.7 compared to the mean for the whole group of 73.3.

Weight and Physical Fitness Indices.—In body weight the individuals in the series examined ranged from a minimum of 122 pounds to a maximum of 198 pounds. The mean weight for the series was 158.80 pounds. A study of the scattergram of weight and the physical fitness scores reveals the fact that there is extremely little relation between the two variables. The Pearsonian product moment correlation yields a value of —0.07. In spite of the low correlation figure, there appears to be a tendency for the individuals with low physical fitness indices to be more frequently above the mean in body weight.

Chest Circumference and Physical Fitness Indices.—Chest circumference at rest (measured between inspiration and maximum expiration) exhibits a low negative correlation with the physical fitness index. The product moment correlation yields a value of —.15 ± .04. In other words, as the chest circumference increases there is a slight decrease in the value of the physical fitness index.

Length of Lower Extremities and Physical Fitness Indices.†—The relation between the length of the lower extremities and the physical fitness indices is similar to that found in the case of stature. The two variables are virtually independent and the correlation coefficient is 0.04.

Lower Leg Length and Physical Fitness Indices.—Again there appears to be an absence of any relation between the two variables, lower leg length (tibial) and physical fitness scores being entirely independent. The value of the product moment correlation coefficient is 0.01.

Height ÷ Cube Root of Weight and Physical Fitness Indices.—The height ÷ cube root of weight ratio is a useful index of general body build. The higher the index the more linear the physique and conversely the lower the index the more lateral and thick-

† The length of the lower extremities was obtained by subtracting the sitting height from the total stature of the individual.

set is the body type. An analysis of the scattergram for height ÷ cube root of weight and physical fitness scores showed the presence of a low positive association between the two variables when the correlation is considered as being linear. The Pearsonian product moment coefficient for these data is .16 ± 0.04. However, an examination of the scattergram suggested the possibility that the association between the two variables may be curvilinear rather than linear. Accordingly, a correlation ratio was computed which resulted in the much higher value of 0.39 ± 0.03. This appears to confirm the existence of a curvilinear relation between the ratio height ÷ cube root of weight and physical fitness indices. The association present is restricted for the most part to the lower values of the height ÷ cube root of weight ratio. In other words, the individuals with the more stocky, thick-set type of body build tend to have low physical fitness indices.

PACK TEST
(End of Training Period)

Physical Fitness Indices at the End of the Training Period.— Physical fitness scores were obtained for 290 of the subjects at the end of the training period. The training period extended over an eight-week period during which the aspect of physical conditioning occupied a major portion of the cadet's time. The Pack Test method was used again to obtain the fitness scores. It was found that there was a substantial improvement in the physical fitness indices as a result of the conditioning program. The scores now ranged from 61 to 114 with a mean for the group as a whole of 81.95. This represents a mean increase for the group of 8.60 units.†† In addition there was a marked decrease in the variability of the scores for the group with the standard deviation now being 6.75. The form of the frequency distribution was also modified as a result of the training period from a slightly asymmetrical type to a normal symmetrical distribution. The actual figures for the frequency distribution of the subjects at the end of the training period are given below:

Physical Fitness Scores	*No.*	*Cumulative Percentage*
60 - 64	1	.3
65 - 69	6	2.4
70 - 74	21	9.6
75 - 79	81	37.5
80 - 84	93	69.6
85 - 89	54	88.2
90 - 94	20	95.1
95 - 99	9	98.2
100 - x	5	99.9
	290	

††This is a statistically significant difference, the critical ratio being 11.78 standard errors.

The extent of improvement of the physical fitness scores as a result of the conditioning program is readily apparent and may be illustrated by the fact that, whereas at the beginning of the training period 46.7% of individuals had scores below 75 (average for Harvard College), at the end of the training period only 9.6% of individuals showed scores of less than 75.

Stature and Physical Fitness Indices at End of Training Period.—When stature was correlated with the Pack Test scores at the end of the training period it was found that there was an absence of any association between the two variables. The scattergram showed a perfectly random distribution with no evidence of significant linear or curvilinear relationship. The product moment coefficient computed for these data was —0.05 ± 0.04.

Weight and Physical Fitness Indices at the End of the Training Period.—As a result of the training period there appeared only a slight drop in the average weight of the individuals in the series. The mean weight at the end of the training period for the group as a whole was 155.60 pounds compared to 158.80 pounds at the beginning of the conditioning program.

Body weight and physical fitness scores at the end of the training period appear to be completely independent. The scattergram shows a random distribution and the product moment coefficient of correlation value is —0.01.

Chest Circumference and Physical Fitness Indices at End of Training Period.—The low negative correlation between chest circumference and the physical fitness index found at the beginning of the training period disappears at the end of the training period. The coefficient of correlation drops from —.15 to —.03.

Length of Lower Extremities and Physical Fitness Indices at End of Training Period.—The coefficient of correlation between the length of the lower extremities and the physical fitness scores at the end of the training period is —0.10 ± 0.04. This is a low value and is not statistically significant beyond the error of random sampling. The trend if anything is in a negative direction. For all practical purposes it may be said that the length of the lower extremities and these physical fitness scores are uncorrelated.

Lower Leg Length and Physical Fitness Indices at End of Training Period.—There appears to be a very low negative association between lower leg length (tibial) and the physical fitness scores at the end of the training period. The product moment coefficient of correlation value is —0.14 ± 0.04. An examination of the scattergram shows that there is a very slight tendency for those individuals with the shorter lower leg lengths to have somewhat higher physical fitness scores. Thus, the 132 individuals with lower leg lengths below 40.5 centimeters have an average physical fitness score of 83.3 com-

pared to the 23 individuals with the longest lower leg lengths (43.5 cms. and higher) who have an average physical fitness score of 79.6.

Height ÷ Cube Root of Weight and Physical Fitness Indices at End of Training Period.—The variation in the height ÷ cube root of weight ratio for this series seems to be entirely independent of the variation of the physical fitness scores at the end of the training period. The product moment coefficient of correlation between the two variables is —0.02. This absence of association is in contrast to what was found when the physical fitness scores were obtained at the beginning of the training period. There is no evidence of curvilinear relation in the scattergram as was apparent in the physical fitness data at the beginning of the training period.

THE STEP TEST AND ANTHROPOMETRIC CHARACTERISTICS

There are three points of differentiation between the Step Test and the Pack Test. In the Step Test the subject does not carry a pack, he does not hold on to a parallel bar with his hands, and the height of the step is raised from 16 inches to 20 inches. Thus, in the Step Test the subject is much more dependent on his lower extremities, his motor coordination, and balance than in the case of the Pack Test. Accordingly, it is of considerable interest to inquire as to the effect of these new factors on interrelation of morphological characteristics to the physical fitness index.

Table I gives the coefficients of correlation between various anthropometric measures and the physical fitness scores obtained by the Step Test. These scores were obtained soon after the beginning of the training period. It may be seen that the correlation values obtained are almost identical with those found for the Pack Test in the beginning of the training period. In other words, stature, weight, lower extremities' length, and lower leg length are for all practical purposes independent of the physical fitness scores obtained by means of the Step Test, while the height ÷ cube root of weight ratio shows a low degree of association when the variables are handled in a linear fashion and a moderate degree of association when the

TABLE I

COEFFICIENTS OF CORRELATION BETWEEN ANTHROPOMETRIC MEASURES AND PHYSICAL FITNESS SCORES (STEP TEST)

	Step Test			
	Beginning Training Period		*At End of Training Period*	
	No.	r	No.	r
Stature	276	.04	247	−.05
Weight	250	−.06	247	.01
Chest Circumference	273	−.16	247	.05
Lower Extremity Length	248	.02	247	−.04
Lower Leg Length (tibial)	250	−.01	247	−.05
Height ÷ Cube Root of Weight	286	.20	247	−.02

variables are considered as having a curvilinear relationship. Chest circumference shows a slight negative association at the beginning of the training period similar to that of the Pack Test.

At the end of the training period, all the coefficients of correlation between the anthropometric characteristics and the physical fitness scores drop to zero. This follows in general the pattern seen in the case of the Pack Test. The exceptions appear with respect to the lower extremity and lower leg lengths.

SUMMARY

The relationship between stature, weight, height ÷ cube root of weight index and physical efficiency was studied in several groups of Harvard College students. The students were in various stages of physical training and their physical fitness scores were obtained by the Treadmill, Pack Test and Step Test. The correlation values between the anthropometric measures and the physical fitness indices are given in Table II.

It can be seen that stature was found to be uncorrelated with physical fitness scores when measured by either of the three tests, Treadmill, Step, or Pack. Weight was uncorrelated in the Treadmill Test and negatively correlated to a low degree in the Pack and Step Test. The height ÷ cube root of weight index was correlated positively to a low degree with all three tests. The results were on the whole similar to those obtained for the aviation cadets before training. The only difference lay in the low negative correlation with body weight for the college students when examined by the Pack and Step Tests. It should be pointed out in this connection that the three tests, Treadmill, Pack Test, and Step Test, were done on different groups of Harvard students. The Pack Test and Step Test figures were derived from random samples of Harvard freshmen, while the Treadmill Tests were done on a selected group of Grant Study students. The latter were by and large in a higher state of physical efficiency than the freshmen, which may account for the lower correlative value obtained for weight by means of the Treadmill Tests.

TABLE II

COEFFICIENTS OF CORRELATION BETWEEN ANTHROPOMETRIC MEASURES AND PHYSICAL FITNESS INDICES IN COLLEGE STUDENTS

	College Students					
	Treadmill		*Pack Test*		*Step Test*	
	No.	r	No.	r	No.	r
Stature and PFI	175	.03	247	.08	224	.05
Weight and PFI	175	−.08	249	−.26	223	−.22
Height ÷ Cube Root of Weight and PFI	175	.10	246	.26	223	.29

DISCUSSION

The data indicate a virtual absence of relation between stature, weight, chest circumference, lower extremity length, and lower leg length with physical fitness indices derived from the Pack Test and Step Test in a group of aviation cadets before and after a severe physical training period. (A summary of the coefficients of correlation is given in Table III.) In spite of the low coefficient values there are suggestions that, before training, the extremely short individuals with stature below 165 centimeters show a slight tendency to have rather low physical fitness indices, and the individuals with low physical fitness indices tend more frequently to be above the mean in body weight. These latter associations are minor and for practical purposes in large scale testing, may be ignored in assessing the individual's physical fitness. When the individuals attain a state of physical efficiency of a higher level commensurate with a severe degree of physical training, the correlations with the anthropometric characteristics become even smaller or disappear entirely.

It is with the general index of body build, the height ÷ cube root of weight ratio, that we find some relation with physical fitness. This relationship is not very high and is restricted for the most part to the lower values of the body ratio. Thus, the data indicate that those individuals who are stocky, and thick-set in body build tend to have low physical fitness indices before training. It should be noted that this relation disappears when the individuals approach their optimum state of physical efficiency. The suggestion is, therefore, that when stocky, thick-set individuals are well below the peak of their physical efficiency they tend to have lower physical fitness indices than the more linear type of person; and that after severe physical conditioning the thick-set individuals approach the level of efficiency of the linear individual. The data derived from tests made on more than 500 college students incline to support the findings seen for the aviation cadets.

Work previously reported indicated a relationship between the masculine component of the body build and physical fitness.* It appears further from the data here presented, that body-build types are related to degrees of physical efficiency, at least insofar as this is indicated by the Step, Pack, and Treadmill Tests. This applies particularly to individuals who are below their optimum state of physical conditioning. The statistical methodology we have employed fails to bring into sharp focus the existence of localized inter-relationship in the present study. The product moment coefficient of correlation being a summative constant and expressing average tendency, serves to obscure those sporadic variations between vari-

*Carl C. Seltzer and Lucien Brouha, "The 'Masculine' Component and Physical Fitness," *Am. J. Phys. Anthrop.*, N.S., Vol. 1 (March, 1943), pp. 95-108.

TABLE III

COEFFICIENTS OF CORRELATION BETWEEN ANTHROPOMETRIC CHARACTERISTICS AND PHYSICAL FITNESS INDICES

	Aviation Cadets								College Students					
	Pack Test				*Step Test*				*Treadmill*		*Pack Test*		*Step Test*	
	Beginning Training Period		At End of Training Period		Beginning Training Period		At End of Training Period							
	No.	r	No.	r	No.	r	No.	r	No.	r	No.	r	No.	r
Stature and Physical Fitness I.	306	.04	286	−.05	276	.04	247	−05	175	.03	247	.08	224	.05
Weight and Physical Fitness I.	277	−.07	290	−.01	250	−.06	247	.01	175	−.08	249	−.26	223	−.22
Chest C. and Physical Fitness I.	306	−.15	286	−.03	273	−.16	247	.05						
Lower Extrem. Length Phys. Fitness I.	274	.04	273	−.10	248	.02	247	−.04						
Lower Leg Length Phys. Fitness I.	273	.01	276	−.14	250	−.01	247	−.05						
Ht. ÷ Cube Root of Wt. and Phys. Fitness I.	306	.16*	286	−.02	286	.20**	247	−.02	175	.10	246	.26	223	.29

* Correlation ratio for the same data gives value of .39 ± .03.

** Correlation ratio for the same data gives value of .40 ± .03.

ables which are strongly related. The stature ÷ cube root of weight and physical fitness index correlation is a case in point. Although in the relatively untrained state the correlation constant suggests a very low degree of relationship between the two variables, a close examination of individual members of the scattergram reveals a high degree of relationship for certain body build types. If we take, for example, those individuals with height ÷ cube root of weight indices below 12.0 we find that those among them who are either endomorphic mesomorphs or mesomorphic endomorphs display very low physical fitness indices. Some of these individuals also show slight degrees of weakness in the masculine component. The rest of the individuals in the very low height ÷ cube root of weight bracket (dominant mesomorphs with low endomorphic and ectomorphic components) show on the contrary average physical fitness indices. There are undoubtedly other examples of body-build types which show close relationships with physical fitness such as the mesopenic (marked deficiency in mesomorphy) individuals. This problem involves a whole area of study which cannot be adequately handled by the relatively crude index of body build such as the height ÷ cube root of weight ratio, but which must be investigated through the medium of a finely graded morphological typing, exemplified by the somatotyping technique. All that the present data indicate is that on the average there is a low degree of association between body-build forms and the physical fitness index.

The other consideration in this study involves the question of the necessity for making corrections for variations in stature and leg length. Does the very tall person with long legs have an advantage over the very short individual in the Pack Test and particularly in the Step Test owing to the fact that these tests involve a stepping-up process of 16 and 20 inches respectively? If this were true, we should expect that the taller individuals with the longer legs would tend to have higher physical fitness indices than the shorter-legged individuals. From the data presented there is no evidence of any appreciable advantage in physical fitness scores of the tall, long-legged individuals over the short-stature, short-legged persons. There is an indication that the extremely short individuals (statures below 165 cms.) tend somewhat to run lower physical fitness scores than the taller individuals when the training period had just started. But this relation is not found at the end of the training period. As a matter of fact, the data suggested that the reverse was true at the end of the training period; namely, that there was a slight tendency for those individuals with the shorter leg lengths to have somewhat higher physical fitness scores. In any event, the variations found before and at the end of the training period were of such minor nature that for all practical purposes it may be considered that abso-

lute stature and leg length do not affect the physical fitness indices obtained by means of the Pack Test or the Step Test. No corrections for stature or leg length are necessary in the computation of the physical fitness index obtained by these methods.

This study also indicates the general futility of attempting to obtain significant relationships between general physical capacity and isolated linear or volumetric measurements. The organism cannot be dissected in this manner and still yield profitable relationships with measures of general physical capacity. Emphasis should be placed on the total physique and less on its individual parts. In this connection, the description of the total physique through the method of somatotyping presents considerable practical advantages.

Relation Between Leg-Lift and Sit-Up

By PETER V. KARPOVICH, RAYMOND A. WEISS AND EDWIN R. ELBEL
Army Air Forces School of Aviation Medicine
Randolph Field, Texas

(Submitted for publication December, 1945)

INTRODUCTION

AFTER the official Army Air Forces Physical Fitness test* had been in use for several months, the question was raised as to whether or not sit-ups could be replaced by leg-lifts. Some instructors of physical training contended that the leg-life would measure endurance of the same muscles and that the discomfort often felt after the sit-ups would be reduced.

Since there is a large degree of kinesiologic similarity between the sit-up and leg-lift, because both of them involve flexion in the hip joint and in the lumbar spine, it seemed worth while to investigate the degree of correlation between these two tests.

EXPERIMENTAL PROCEDURE

The reliability of the sit-ups had been previously established[1] making it necessary only to determine the reliability of the leg-lifts and then find the coefficient of correlation between the number of leg-lifts and sit-ups. For reliability, a group of 101 aviation cadets was given two leg-lift tests with an interval of one week between the testing days.

The comparison of leg-lifts and sit-ups was done on 224 Aviation Cadets. All subjects in this study were stationed at the Army Air Forces Preflight School, San Antonio Aviation Cadet Center, Texas. To avoid bias in the experiment caused by testing order, the cadets were randomly divided into two numerically equal groups, A and B. During the first test period, Group A performed leg-lifts and Group B performed sit-ups. During the second test period, four days later, Group A did sit-ups and Group B, leg-lifts.

DESCRIPTION OF THE EXERCISES

The leg-lifts were performed from a supine position. The legs were lifted to the vertical, and then lowered to the ground. The feet were held together with the legs straight throughout the entire movement.

The sit-ups were also done from a supine position with the feet comfortably apart and the hands clasped behind the head. The ankles

* The Army Air Forces Physical Fitness Test consists of sit-ups, chinning and a 300-yard shuttle run.

1 P. V. Karpovich, "The Reliability of the AAF Physical Fitness Test," Project No. 184, Report No. 1, AAF School of Aviation Medicine, Randolph Field, Texas, October 20, 1943.

were held firmly on the ground by another subject. The performer lifted his trunk, leaned forward, touched his right knee with his left elbow and then lowered the trunk, touching the head to the ground. He then repeated the movement touching the right elbow to the left knee. The exercise was done continuously without pause, the subject alternately touching each knee with the opposite elbow. The subjects continued each exercise to the limit of their endurance.

To facilitate counting and recording, the men were paired. One subject performed the exercise while his partner counted. After the score was recorded, the men changed places and the counter became the performer. During the sit-ups, the counter also held his partner's ankles.

ANALYSIS OF THE DATA

The reliability coefficient of the leg-lift, ascertained from the test-retest data of 101 subjects, was found to be + .72 as shown in Table I. The mean for the first test was 44.3 and the standard deviation was 14.1. For the second test the mean was 44.0 and the standard deviation was 16.5.

The reliability coefficient for sit-ups as previously determined was + .71. A comparison of the reliability coefficients for sit-ups and leg-lifts show both these test items to be acceptably reliable.

The data for the 224 cadets in groups A and B were pooled for each of the tests. The mean for sit-ups was determined to be 87.0 with a standard deviation of 31.5; the mean for leg-lifts was 63.8 with a standard deviation of 27.5. The coefficient of correlation between sit-ups and leg-lifts was + .38. Although statistically significant,** this correlation coefficient is, nevertheless, too low for the exercises to be used interchangeably for testing purposes.

COMMENTS

On account of the similarity of the main muscle groups for each exercise, a higher coefficient of correlation was expected. However, the sit-up is more complex than the leg-lift, because it employs additional movements such as flexion of the neck, rotation of the vertebral column and extension of the spine on return to the lying position. Therefore, apparently more muscles are used in the sit-up than the leg-lift. It is possible that the difference in the number of the muscle groups used in these two exercises is responsible for the low coefficient of correlation between them.

With respect to discomfort and soreness, which sometimes lasted for several days after sit-ups, the leg-lifts apparently were not an improvement. When all subjects were requested to indicate their preference

** To be significant at the one percent level r should exceed only + .25.

from the standpoint of minimum discomfort, their choice was equally divided between the two tests.

TABLE I

STATISTICAL DATA FOR LEG-LIFT AND SIT-UP TESTS

	Leg-Lifts		*Sit-Ups*	
	1st Test	*2nd Test*	*1st Test*	*2nd Test*
Test for Reliability				
Number of Subjects	101	101	122*	122*
Mean	44.3	44.0	63.1	61.9
Standard Deviation	14.1	16.5	23.4	20.5
Reliability Coefficient		+.72		+.71
Test for Correlation				
Number of Subjects	224		224	
Mean	63.8		87.0	
Standard Deviation	27.5		31.5	
Correlation Coefficient		+.38		

* Sit-up data for 122 subjects were taken from reference number 1.

An Analysis of the Physical Education Programs of the Minnesota Secondary Schools

By HAROLD K. JACK
State Department of Education
St. Paul, Minnesota

(Submitted for publication October, 1945)

STATEMENT OF THE PROBLEM

THE problem presented by this investigation was to determine the relationship between certain factors of the physical education program and conditions such as (1) size of enrollment, (2) wealth of school district, (3) percentage of pupils transported, and (4) training of teachers.

The factors selected for the study were:

1. Number of required years of physical education
2. Number of periods per week of physical education
3. Length of physical education class period
4. Size of physical education class
5. Range of activities in the physical education program
6. Intramural program
7. Number of gymnasiums available
8. Supplementary indoor physical education facilities
9. Size of playground
10. Location of playground
11. Additional subject load of physical education teachers
12. Coaching responsibilities of physical education teachers
13. Extracurricular responsibilities of teachers in addition to physical education
14. Giving of grades in physical education.
15. Expenditures for physical education supplies and equipment
16. Training of teachers
17. Experience of teachers
18. Suitable dress for physical education class
19. Required showers
20. Towel service
21. Tests
22. Permanent record form

This is an abstract submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education of New York University, 1944.

The first subproblem was based upon the assumption that certain factors in the administration of physical education programs are characteristic of schools of various sizes of enrollment. The purpose of this subproblem was to determine for each of the selected factors the general situation that existed in the public secondary schools throughout the State of Minnesota in 1941-1942 and, also, to determine the situation that existed in regard to each of the factors in the schools when grouped according to size of enrollment.

In the second subproblem it was assumed that wealth of the school district might have some relationship to certain factors of the physical education program. The problem, therefore, was to determine the relationship between wealth of school district and such factors as might be concerned with it. (Factors studied were 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 15, and 20.)

The third subproblem was based upon the assumption that pupil transportation usually affects the physical education program because the transported pupils leave by bus immediately following the close of classes in the afternoon. The problem was to determine the relationship between the percentage of pupils transported and those factors of the physical education program which might be affected by a high percentage of transported pupils in the school. (Factors studied were 1, 2, 5, and 6.)

In the fourth subproblem it was assumed that there is a relationship between the training of the teacher and certain factors of the physical education program. The problem was to determine the relationship between certain factors of the physical education program and the training of the teachers in terms of teacher certification, and, also, in terms of the type of institution at which the training was obtained. (Factors studied were 5, 6, 18, 19, 21, and 22.)

NEED FOR THE STUDY

Since schools vary in size of enrollment, wealth of school district, and percentage of transported pupils, and since teachers vary in training in physical education as well as in the institutions in which they received their training, there is definite need to determine how each of these affects the physical education program. It was assumed that it would be much easier to make a critical analysis of a program in physical education after relationships between the factors and conditions studied in this investigation had been determined.

The study will be of value to institutions engaged in teacher training because it indicates to some extent the results of the teacher-training program and presents a quantitative analysis of selected problems related to the operation of physical education programs in all sizes of schools. Teachers of physical education and school ad-

ministrators will likewise be able to evaluate their programs of physical education.

Although considerable progress in the field of physical education has been made in Minnesota since the health and physical education law was passed in 1923, this study should indicate steps for future development.

METHOD OF PROCEDURE

The data for the study were obtained from two main sources: first, from two special reports which were sent to all public secondary schools in the State of Minnesota and, second, from the various reports of the local school districts on file in the State Department of Education.

For the first subproblem the schools were divided into five groups on the basis of enrollment in grades nine through twelve: (1) enrollments of 1 through 80; (2) enrollments of 81 through 200; (3) enrollments of 201 through 400; (4) enrollments of over 400; and (5) enrollment of schools in the three largest cities (Minneapolis, St. Paul, and Duluth). The status of each of the twenty-two selected factors in each of the five enrollment groups, and for the state as a whole, was determined by means of measures of central tendency and variability wherever possible. Where measures of central tendency could not be computed, the data were treated in terms of percentages.

In the second subproblem, which dealt with the ability of the school district to pay for educational services, the relationships between wealth of school district and certain factors of the physical education program were obtained by correlations (product-moment and biserial).

In the third subproblem, in studying the various relationships that existed between percentage of pupils transported and certain factors of the physical education program, schools were again grouped according to size of enrollment because size of school may have some relationship to the problem. Since none of the schools in the three large cities transport pupils, it was decided not to include them in this phase of the problem because they would undoubtedly affect the rest of the picture to such an extent that the findings would be distorted. Product-moment and biserial correlations were computed in determining the relationships.

For the fourth subproblem teachers were grouped according to the type of institution at which they had received their training (University of Minnesota, Minnesota state teachers' colleges, Minnesota private colleges, and out-of-state institutions). Within each of these four groups of institutions, the teachers were again grouped according to level of certification for physical education (major, minor,

nine-quarter hour endorsement, and no certification in physical education). To determine the relationship between the selected factors and the training of teachers in terms of certification level and type of institution at which training was received, measures of central tendency and variability were computed, wherever possible, for each of the certification groups and for each of the institution groups. Where measures of central tendency could not be computed, the data were shown in terms of percentages.

FINDINGS

1. Twenty-two percent of the schools required physical education beyond the tenth grade for boys, and 21 percent required it beyond the tenth grade for girls. The small schools and the large schools required physical education beyond the tenth grade more often than did the medium-sized schools.

2. Only nine percent of the schools required physical education more than an average age of two periods per week. In general, as size of school enrollment increased, the percentage of schools requiring physical education for more than two periods per week increased.

3. Seventy-six percent of the schools assigned sixty minutes to physical education classes, 2 percent had a combination of forty-five- and sixty-min. te periods, and the remaining 22 percent had forty-five minute periods. As size of school enrollment increased, the percentage of schools assigning sixty minutes to physical education class periods increased.

4. The mean physical education class for the state was found to be 34.46 pupils and the median class was 32 pupils. As size of school enrollment increased, the mean and median class size also increased. The mean class size ranged from 25.73 pupils in the schools of the 1-80 group to 47.39 pupils in the three cities. The median ranged from 25 pupils in the schools of the 1-80 group to 43 pupils in the three cities.

5. The mean number of activities in the physical education program was found to be 16.83 activities for boys and 16.67 activities for girls. The median in both cases was found to be 16 activities. As size of school enrollment increased, the mean and median number of activities increased up to and including the schools of over 400 enrollment. The mean and median number of activities in the schools of the three cities did not continue the trend shown in the other groups.

6. The mean number of intramural activities included in programs for boys was found to be 4.08 activities and the mean number of intramural activities in programs for girls, 6.34 activities. In every enrollment group the program for girls contained more activi-

ties than did the program for boys. No trend was observed regarding number of activities in relation to size of school except that the schools of over 400 enrollment and those in the three cities had the greatest number of activities in their programs. It was further observed that men teachers devoted somewhat more time to intramural activities than did women teachers.

7. Seventy-two percent of the schools had one gymnasium in the school building, 18 percent two or more, 8 percent had to use a gymnasium located in another building, and 2 percent had no gymnasium available for physical education class work.

8. Thirty-three percent of the schools had at least one supplementary indoor physical education facility. The majority of these had only one, however.

9. The mean-sized playground was found to be 457 square rods, or not quite three acres. The medians for the various enrollment groups were all about equal and the means show no trend. In general, playgrounds seem to be quite similar for all types of schools.

10. Seventy-six percent of the schools had playgrounds adjacent to the school building and very few schools had playgrounds more than one-tenth of a mile distant from the building. As size of school enrollment increased, the percentage of schools having playgrounds adjacent to the school building decreased.

11. The average number of periods of teaching in other fields required of physical education teachers was found to be 16.33 periods per week and the median was found to be 20 periods per week. As size of school increased, the number of periods that the physical education teacher taught in other fields decreased.

12. Seventy-eight percent of the men teachers of physical education act as head coach in one or more sports. It is significant that, as size of school enrollment increased, the percentage of men physical education instructors assigned as head coach decreased.

13. Men physical education teachers were assigned an average of .96 extracurricular activities and women teachers an average of 1.78 activities. The range was from zero to eight activities for both sexes. As size of school increased, with the exception of the three large cities, the mean extracurricular assignment for women decreased. For men no trend was observed, although the men teachers in the smaller schools had fewer extracurricular assignments.

14. The use of letter grades, A to F, or their percentage equivalents was most popular among the various enrollment groups. The greatest number of schools giving no marks was found among the smaller institutions and the greatest number of schools using the S and U method of marking was found among the larger ones.

15. The mean per-pupil expenditure for physical education equipment and supplies was 31 cents. In general, as size of school

enrollment increased, the mean per-pupil expenditure for physical education equipment and supplies decreased.

16. As size of school enrollment increased, the percentage of teachers holding a special certificate in physical education increased. The majority of teachers holding no certification in physical education were found in the small schools.

17. The mean teaching experience for men teachers was found to be 6.53 years and for women teachers 4.94 years. As size of school enrollment increased, the percentage of schools requiring pupils to women teachers increased.

18. Seventy-five per cent of the schools required girls to dress for physical education class and only 58 percent of the schools required boys to dress for physical education class. As size of school enrollment increased, the percentage of schools reqiuring pupils to dress for physical education class increased.

19. With the exception of the three large cities, as size of school enrollment increased, the percentage of schools requiring shower baths at the conclusion of the physical education class period increased. Sixty-one percent of the schools required showers for boys at the conclusion of the physical education class period and 50 percent required showers for girls at the conclusion of the class period.

20. With the exception of the three large cities, as size of school enrollment increased, the percentage of schools in each enrollment group furnishing towels to pupils increased. The percentage was about the same for boys as for girls in each enrollment group. For the state as a whole 12 percent of the schools had a towel service for boys and 11 percent had a towel service for girls.

21. The most common tests given by teachers to pupils in physical education were the Brace, Burpee, Rogers, Physical Capacity, achievement tests in skills, Sargent Jump, National Recreation Association achievement tests, Neilson-Cozens achievement tests, posture tests, and decathlons. As size of school enrollment increased the percentage of schools giving one or more types of tests increased, with the exception of the program for boys in the three large cities. Sixty-one percent of the schools gave tests to the boys and 60 percent gave tests to the girls. In addition, as size of school enrollment increased, the percentage of schools giving two, three, or four types of tests increased.

22. As size of school enrollment increased the percentage of teachers using permanent record forms increased, with the exception of the three large cities. A total of 8 percent of the men teachers used permanent record forms and 6 percent of the women teachers used permanent record forms.

23. In general there is little or slight relationship between wealth

of school district and any of the thirteen selected factors studied. The correlations obtained are listed in Table I.

TABLE I

RELATIONSHIP BETWEEN WEALTH OF SCHOOL DISTRICT AND THE THIRTEEN SELECTED FACTORS

Factors		*Correlations*
Size of physical-education class		— .02 ± .01
Per pupil expenditures for physical education supplies and equipment		.27 ± .03
Number of supplementary indoor physical-education facilities		.37 ± .03
Size of playground		.20 ± .03
Additional subject load of physical-education teachers		— .42 ± .02
Extracurricular responsibilities of teachers in addition to physical education	(men)	.00 ± .03
	(women)	— .08 ± .03
Length of physical-education class period		.11 ± .04
Number of periods per week of physical education		.27 ± .05
Number of required years of physical education		.25 ± .04
Number of gymnasiums available		.22 ± .05
Location of playground		.00 ± .05
Towel service		.35 ± .04
Coaching responsibilities of physical-education teachers		— .03 ± .04

24. There seems to be either no relationship, or only a slight negative relationship, between percentage of pupils transported and each of the four factors studied. The correlations obtained are listed in Table II.

TABLE II

RELATIONSHIP BETWEEN PERCENTAGE OF PUPILS TRANSPORTED AND THE FOUR SELECTED FACTORS

Factors		*Correlations*
Required years of physical education		.13 ± .04
Periods per week of physical education		— .14 ± .06
Number of activities in intramural program	(men)	— .09 ± .03
	(women)	— .23 ± .03
Number of activities in physical-education program	(men)	— .19 ± .03
	(women)	— .14 ± .03

25. As the training of the teachers increased, the physical education programs became superior in so far as the following factors are concerned: range of activities in the physical education program, number of activities in the intramural program, the use of tests, suitable dress requirement, and the use of a permanent record form. In regard to one factor, required showers, the teachers with minors in physical education had the largest percentage, with the majors ranking second, nine-quarter-hour endorsements third, and no physical education certification fourth and last. No distinct difference between types of institutions exists that is sufficiently significant to indicate that any one type of institution is superior to another in training teachers to carry out and develop the six selected factors studied in relation to training of teachers.

CONCLUSIONS

From the findings of this investigation the following conclusions were drawn:

1. School enrollment does have a relationship to the physical education program in regard to some factors but not in regard to others. In regard to six of the twenty-two factors studied, the situation in the small school is as desirable as or better than the situation in the larger schools. Factors, such as number of years of required physical education, size of playgrounds, and marking plan used in physical education, show no significant difference between large schools and small ones. Other factors, such as location of playground, physical education expenditures per pupil, and enrollment of physical education classes indicate that the small school has an advantage over the large school. Thus, one could reasonably expect that as far as these factors are concerned, the small school should be able to offer a superior program.

There are, however, certain factors in which the large school appears to be superior, such as number of periods of physical education per week, the use of sixty-minute periods, the number of activities in the class program, the number of activities in the intramural program, the presence of a gymnasium in the school building, the number of teachers holding a major in physical education, the experience of teachers, the requirement of suitable dress for physical education class, the requirement of showers, the use of tests, the presence of a towel service, the use of permanent record forms, the number of periods physical education instructors teach in other fields, the number of men teachers acting as head coach, the number of extracurricular assignments for teachers, and the number of supplementary indoor physical education facilities.

2. The wealth of a school district has, for the most part, little relationship to the physical education program.

3. No relationships were obtained that were significant between percentage of pupils transported and number of required years of physical education, number of required periods of physical education per week, number of intramural activities, and range of the physical education class program. This would indicate that as far as these factors are concerned, the presence of a large number of transported pupils has little relationship to the factors studied.

4. As training of teachers increased the physical education programs became superior, insofar as the six factors measured were concerned, with the exception that majors did not rate as well as minors in the matter of shower requirements. The small school is faced with the problem of an adequately trained teacher. However, these six factors are largely administrative and the less highly trained person could direct them in a satisfactory manner.

5. The type of institution at which the teacher received his or her training seemed to make little difference. The amount of training received appeared to be more important.

RECOMMENDATIONS

Based upon the results of this study, the investigator wishes to make certain recommendations relative to the program in physical education for Minnesota schools. The study revealed that certain basic principles should be adopted as standards for the physical education programs in the public schools of the state.

1. Inasmuch as physical education is required by law, schools should be required to teach a minimum program of activities and maintain sufficient supplies and equipment so that teachers can teach the minimum program outlined in the state course of study.

2. A definite plan of marking in physical education should be established.

3. Physical education should be required by law in grades eleven and twelve.

4. Sixty-minute periods should be required for physical education instruction or a double forty-five-minute period.

5. More definite requirements covering dress for physical education class and a shower bath at the conclusion of the class period should be established.

6. A towel service should be required of all schools inasmuch as shower baths are required of pupils.

A Comparative Analysis of Secondary-School Boys' and Girls' Character and Personality Traits in Physical Education Classes

By B. Everard Blanchard
Dixie County High School
Cross City, Florida

(Submitted for publication, October, 1945)

INTRODUCTION

WHETHER or not participation in physical education activities builds character has often been doubted. Some educators have even gone so far as to censure certain interscholastic competitive athletics for fear that the value of an education might be degraded; however, the majority of eminent school leaders have had the inclination to look on the best side of things, empirically believing that everything happens for the best.

During recent years there has been a pronounced emphasis on what is aptly termed "character education." The Tenth Yearbook of the Department of Superintendence, defines a suitable curriculum in character education as follows:

> A curriculum which brings to youth a consciousness of the problems of life, some understanding of these problems, a sense of personal responsibility in contributing to their solution, a reasonable degree of technical efficiency of procedure, and a rich personal life in harmony with the good of others, is achieving the ends of character education.[1]

The Advisory Committee on Education has stated[2] that character education affords an excellent opportunity for the development in pupils of the ability to direct their own affairs in a cooperative spirit. High crime ratios in the age groups under 20, and delinquency among younger children, have created the need for more than the incidental treatment of character education that prevails in many school systems.[3]

The field of physical education offers a fertile channel through which the alert physical educator may provide physically wholesome and mentally stimulating activities that might aid self- and/or group improvement in such expressions as justice, courtesy, obeying the rules of the game, and exercising honesty and fairness in athletic

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1 Department of Superintendence (now American Association of School Administrators). *Character Education*. Tenth Yearbook. Washington, D. C.: National Education Association, 1932, p. 192.

2 Education in the Forty-eight States, The Advisory Committee on Education, Staff Study No. 1. Washington, D. C.: Superintendent of Documents, 1939, p. 70.

3 *Ibid.*, p. 70.

competition. Without some worthy goal or purpose in view, the physical educator is in a most difficult position. It has been stated[4] that only recently the schools have begun to realize that there is as wide variation in mental and emotional control among children as there is in intellectual capacity or in physical fitness. To protect the child against harmful emotional and psychological disturbances in the classroom is no less important than to protect him against bad physical conditions.[5] Teachers can do much to remove fear of failure and unwholesome competition both of which often lead to harmful mental conditions in children.[6]

The aims of physical education might roughly be broken down into two groups: those concerned with physical development and those concerned with character development. Physical educators of yesterday were for the most part satisfied with the first objective, but modern teachers are not content to do only a good job of body building, despite the fact that physical fitness is once more receiving special emphasis. Current theory holds that team games such as basketball can help to develop desirable personal traits in the player.[7]

In the summary of education for all american youth as prepared by the Planning and Executive Committees and the Implementation Commission of the National Association of Secondary-School Principals, two of the salient features as mentioned might be considered as related to character and personality enrichment. The program involves (1) development of an understanding of the relation between health and personality development; (2) maintenance of balance between work and play, social relationships with emotional adjustments, and causes of emotional unbalance; and (3) parental education regarding emotional problems occurring at different age levels.[8]

That character education should be a major objective in physical education is a *sine qua non*. We should know not only *where* we are going, but *why*. It has been stated by the Advisory Committee on Education,[9] that recognition of the fact that not only are there subjects to be studied but also a life to be lived has given a new emphasis

4 *Ibid.*, p. 83.

5 *Loc. cit.*

6 *Loc. cit.*

7 Virginia Nilles, "Tip the Scale in the Right Direction!" *Official Basketball Guide*, National Section on Women's Athletics of the American Association for Health, Physical Education, and Athletics. New York: A. S. Barnes and Co., 1945-'46, p. 21.

8 *Planning For American Youth, An Educational Program for Youth of Secondary-School Age.* Washington 6, D. C.: National Association of Secondary-School Principals, 1940, p. 54.

9 *Op. cit.*, pp. 69-70.

to the pupil in the educational process. This new point of view seeks to develop purposes as well as abilities and opens the way to a much-needed emphasis upon another major responsibility of the curriculum, the provision of suitable materials and methods in character education. It is universally agreed, however, that this subject should receive more systematic attention in the total education of youth. A similar report made for the American Youth Commission states that, of 11,282 young people in Pennsylvania who gave reasons for leaving school, 13 percent did not like school.[10] The extent of the elimination of youth from school as the ascending grade levels are encountered may be due to faulty character and personality adjustments. It is interesting to note, whether important or insignificant, that, of the 10,858 Maryland youths of ages 16 to 24 who reported reasons for leaving school, lack of interest in school accounted for 21 percent and disciplinary trouble amounted to 2 percent.[11]

Julius E. Warren has stated,[12] important as earning a living is, that it is impossible to believe that the thriving business of the divorce court, the jail and mental institutions is due entirely or even in major part to vocational maladjustment. On the contrary, the maladjusted men and women who face these crises betray tragic ignorance in the skills of living with others and ourselves. In our times, conflicts are inevitable for everyone; everyone has to be frustrated more or less regularly. Success in life consists in knowing how to meet these conflicts and frustrations in a direct, constructive way instead of through perversion, over-compensation, hysteria, neurasthenia, rationalization, and the dozen or so other unhealthy mechanisms which are ruinous to the individual and his group.

STATEMENT OF PURPOSE

It is the purpose of this study to make a critical analysis of the character and personality traits of boys and girls participating in physical education classes, to ascertain first, whether or not character and personality traits are continuous in development from the lower to the upper grades, and secondly, whether boys or girls show the greatest development in character and personality traits over a two-year period.

SOURCE OF DATA

The data for this study were collected from regular physical education classes in Dixie County High School, Cross City, Florida.

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10 *Ibid.*, p. 33.

11 *Loc. cit.*

12 Julius E. Warren, "Problems Facing Secondary Education Today," *The Bulletin of the National Association of Secondary-School Principals*, 28:125. (November, 1944), p. 73.

A total of 164 pupils were selected from grades 8 to 11, inclusive. In order that the survey might continue with identical groups over a period of two years, from 1943-'44 to and including 1944-'45, students were selected who thought they would remain in school. The original number decreased however, from 164 to 132, due to the armed forces, transfer of various pupils, lack of interest, and economic reasons. Primarily then, this study deals with 132 students who remained in school for the two-year period. The boy's classes participated in football, basketball, baseball, gym classes, and intramural activities while the girl's classes were confined to participation in basketball, volleyball, shuffleboard, softball, gym classes, and intramurals.

METHOD OF PROCEDURE

In order to appraise the character and personality traits of the 132 students, a revised rating scale for the measurement of character and personality in physical education devised by the writer was used.[13] Table I illustrates the rating scale employed in the study.

TABLE I

BEHAVIOR RATING SCALE

School ..... *Experimental* .....
Control .....
Name of Person Rated ..... *Grade* ..... *Age* .....
Name of Rater ..... *Date* .....

Personal Information:	Frequency of Observation						
	No Opportunity to Observe	Never	Seldom	Fairly Often	Frequently	Extremely Often	Score
Leadership							
1. He is popular with classmates		1	2	3	4	5	
2. He seeks responsibility in the classroom		1	2	3	4	5	
3. He shows intellectual leadership in the classroom		1	2	3	4	5	
Positive Active Qualities							
4. He quits on tasks requiring perseverance		5	4	3	2	1	
5. He exhibits aggressiveness in his relationships with others		1	2	3	4	5	

[13] B. E. Blanchard, Jr., "A Behavior Frequency Rating Scale for the Measurement of Character and Personality in Physical Education Classroom Situations," *The Research Quarterly*, 7:2. (May, 1936), pp. 63-64.

6. He shows initiative in assuming responsibility in unfamiliar situations	1	2	3	4	5
7. He s alert to new opportunities	1	2	3	4	5
Positive Mental Qualities					
8. He shows keenness of mind	1	2	3	4	5
9. He volunteers ideas	1	2	3	4	5
Self-Control					
10. He grumbles over decisions of classmates	5	4	3	2	1
11. He takes a justified criticism by teacher or classmate without showing anger or pouting	1	2	3	4	5
Cooperation					
12. He is loyal to his group	1	2	3	4	5
13. He discharges his group responsibilities well	1	2	3	4	5
14. He is cooperative in his attitude toward the teacher	1	2	3	4	5
Social Action Standards					
15. He makes loud-mouthed criticisms and comments	5	4	3	2	1
16. He respects the rights of others	1	2	3	4	5
Ethical Social Qualities					
17. He cheats	5	4	3	2	1
18. He is truthful	1	2	3	4	5
Qualities of Efficiency					
19. He seems satisfied to "get by" with tasks assigned	5	4	3	2	1
20. He is dependable and trustworthy	1	2	3	4	5
21. He has good study habits	1	2	3	4	5
Sociability					
22. He is liked by others	1	2	3	4	5
23. He makes a friendly approach to others in the group	1	2	3	4	5
24. He is friendly	1	2	3	4	5

The 132 students were divided as follows: in grade 9, 20 boys and 24 girls; in grade 10, 16 boys and 18 girls; in grade 11, 12 boys and 18 girls; and in grade 12, 6 boys and 18 girls. Each pupil made four ratings of four different classmates; thus each pupil was rated four times. The student rater did not rate himself. The boys rated the boys and the girls rated their own sex, the number of ratings being 216 and 312, respectively. One man teacher rated all the boys which amounted to 54 ratings while one woman teacher rated all the girls which accounted for another 78 ratings. The combined total of ratings numbered 660. The boys' ages ranged from 13 years, 4 months, to 17 years, 8 months, while the girls' ages ranged from 13 years, 6 months, to 17 years, 6 months. Table II indicates the results of the tabulations of the scores.

TABLE II

A Two-Year Comparative Analysis of Character and Personality Traits in Identical High School Physical Education Classes of 132 Boys and Girls

(Mean Scores for Each Trait)

	Grade 9						Grade 10						Grade 11						Grade 12						Composite Mean Scores Difference between 43-45 Grades 9-12	
Trait	43-44		44-45		D*		43-44		44-45		D		43-44		44-45		D		43-44		44-45		D			
No.	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
1.	2	2	3	3	+1	+1	2	1	3	3	+1	+2	2	2	3	4	+1	+2	2	2	3	4	+1	+2	2.5	2.6
2.	2	2	2	3	0	+1	2	1	2	3	0	+2	2	2	2	3	0	+1	2	2	3	4	+1	+2	2.1	2.5
3.	1	1	2	3	+1	+2	1	2	2	3	+1	+1	2	2	2	3	0	+1	2	2	2	3	0	+1	1.8	2.4
4.	2	2	2	3	0	+1	2	2	2	3	0	+1	2	2	3	3	+1	+1	2	3	2	3	0	0	2.1	2.6
5.	1	2	2	3	+1	+1	2	1	3	2	+1	+1	2	2	3	3	+1	+1	3	2	3	3	0	+1	2.4	2.3
6.	2	2	2	3	0	+1	2	1	3	3	+1	+2	2	2	2	3	0	+1	2	2	3	3	+1	+1	2.3	2.4
7.	1	2	2	3	+1	+1	1	2	1	3	0	+1	2	2	2	3	0	+1	2	2	3	3	+1	+1	1.8	2.5
8.	2	2	3	3	+1	+1	1	1	2	3	+1	+2	2	2	2	2	0	0	2	2	2	3	0	+1	2.0	2.3
9.	1	2	2	3	+1	+1	1	2	3	3	+2	+1	2	2	3	3	+1	+1	3	3	3	3	0	0	2.3	2.6
10.	2	2	3	3	+1	+1	2	2	2	4	0	+2	2	3	2	4	0	+1	2	2	3	3	+1	+1	2.3	2.6
11.	1	1	2	2	+1	+1	2	2	2	3	0	+1	2	2	3	3	+1	+1	2	3	3	3	+1	0	2.1	2.4
12.	2	1	2	3	0	+2	2	2	2	3	0	+1	2	2	2	3	0	+1	2	2	3	3	+1	+1	2.1	2.4
13.	2	2	2	2	0	0	2	2	2	3	0	+1	2	2	3	3	+1	+1	3	3	3	3	0	0	2.4	2.5
14.	1	1	2	3	+1	+2	2	2	2	3	0	+1	2	2	2	3	0	+1	2	2	3	4	+1	+2	2.0	2.5
15.	2	2	3	3	+1	+1	2	2	2	3	0	+1	3	3	3	3	0	0	4	4	4	4	0	0	2.6	3.0
16.	2	2	2	3	0	+1	3	3	3	3	0	0	3	3	3	4	0	+1	3	3	3	4	0	+1	2.8	3.1
17.	2	2	2	3	0	+1	2	2	3	3	+1	+1	4	4	4	4	0	0	4	4	4	4	0	0	3.1	3.3
18.	3	3	3	3	0	0	3	3	3	4	0	+1	3	4	3	5	0	+1	3	3	3	4	0	+1	3.0	3.6
19.	2	2	2	3	0	+1	2	2	3	3	+1	+1	3	3	3	4	0	+1	3	3	3	4	0	+1	2.6	3.0
20.	3	3	3	3	0	0	3	3	3	4	0	+1	3	3	3	3	0	0	3	3	3	4	0	+1	3.0	3.3
21.	2	2	2	3	0	+1	2	3	3	3	+1	0	3	3	3	3	0	0	3	3	3	3	0	0	2.6	2.6
22.	2	2	2	3	0	+1	2	2	3	3	+1	+1	2	2	3	4	+1	+2	3	3	3	3	0	0	2.5	2.8
23.	2	2	2	2	0	0	3	2	3	3	0	+1	3	3	3	4	0	+1	2	2	3	4	+1	+2	2.6	2.8
24.	2	2	2	2	0	0	2	3	3	3	+1	0	3	3	4	4	+1	+1	3	3	3	4	0	+1	2.8	3.0

*D equals difference between boys and girls for each grade level.

CONCLUSIONS

1. It appears that character and personality traits are affected by participation in physical education activities, the result being that desirable rather than undesirable traits are stimulated.

2. The greatest gain in character and personality traits appears to take place during the sophomore year including both boys and girls.

3. Girls' physical education classes for every grade level show a significant superiority over boys' physical education classes in the acquisition of wholesome character and personality traits.

4. In general, the study reveals that a continuous growth in character and personality traits takes place with each succeeding grade level.

A Differential Analysis of Sit-Ups For Strength and Muscular Endurance

By Ross Wedemeyer
State University of Iowa
Iowa City, Iowa

(*Submitted for publication, August, 1945*)

INTRODUCTION

TODAY, more than at any other time in our history, physical educators are concerned to know how successful our programs of physical fitness are and whether or not certain goals in physical fitness are being achieved.

Strength and muscular endurance have always been important objectives in physical education programs. In our present-day programs, the emphasis on these two factors as related to physical growth and organic vigor has been greatly increased.

In 1944 Dewitt of Louisiana State University conducted a study wherein he used a test which kept the abdominal muscles in continuous or static contraction while supporting the weight of the trunk.[1]* This was accomplished by having the individual lie on the floor, his feet under the bottom rung of a set of stall bars and his hands clasped back of his head. At a signal he raised his body from the waistline up completely clear of the floor, and kept it so as long as possible.

In an attempt to secure a more complete picture of muscular endurance of the abdominal muscles, the static type of test which DeWitt used was not used in this study. In the following study of sit-ups the criterion consisted of a test in which the abdominal muscles were in alternate stages of contraction and relaxation which was in keeping with the type of training program given.

THE PROBLEM

This study is an attempt to analyze the two-minute and the unlimited sit-ups as to their values as measures of strength and endurance of the pertinent muscles.

PROCEDURE

Forty-seven senior high school boys were used as subjects.

* Superior figures refer to bibliography at end of article.

Remarks:

$$\frac{\text{Chest Girth}}{\text{Height}} \qquad \frac{\text{Chest Girth}}{\text{Sitting Height}} \qquad \frac{\sqrt[3]{\text{weight}}}{\text{height}}$$

Fig. 1. Individual Data Card.

Test 1, Two-Minute Sit-ups.—Instructions were given to each individual indicating that he was to do as many sit-ups in two minutes

** These were students of the University Experimental High School at the University of Iowa, Iowa City, Iowa.

Name.....
School.....
Date.....
Grade .....10 .....11 12
Age..... Born..... (year..... month..... day.....)

	First Test	*Date*	*Second Test*	*Date*
Height				
Weight				
Sitting-Up Height				
Chest Girth				
Sit-Ups in 2 min.				
Total Sit-Ups Limit (Unlimited Time)				
Sit-Up Strength				

First Test *Second Test*

2 min. ..... Unlim. 2 min. ..... Unlim.

All the boys had recently had a physical examinat'on. Only boys who had no handicapping physical defects were used.**

The following three tests were given with equipment as listed:

Tests Administered	*Equipment*
1. Total number of sit-ups each boy could do in two minutes at his own rate of speed.	Stall bars, mat 6'x10', stop watch.
2. Total number of sit-ups unlimited time, at a rate of one sit-up each two seconds.	Stall bars, mat 6'x10', metronome.
3. Test for sit-up strength using the Martin Breaking Strength Method.	2 small pulleys arranged as a "block and tackle," a 2" web strap 6' long.
Data as recorded on the individual data card (Figure 1) were collected for each boy.	A hand dynamometer with attachments for pulling, 1 mat 6'x10'.

The first time the tests were administered was during the week of January 22, 1945.

as he possibly could, using the rhythm which suited him the best.

A mat 6′ x 10′ was placed on the floor at the stall bars. Four boys sat on the mat with their legs straight, heels on the floor, toes hooked under the lower rung of the stall bars. The boys' hands were clasped behind their heads; their bodies were lowered backward until both shoulder blades touched the mat simultaneously.

The body was then raised to a sitting position. On the first sit-up, the right elbow touched the left knee; on the second sit-up, the left elbow touched the right knee. This procedure was continued on an alternating basis for the duration of the test. The legs remained as straight as possible.

For each boy taking the test, another boy was chosen to count his number of sit-ups. If at any time the boy's hands slipped from behind his head, and were used as a means of raising the body to a sitting position, that particular sit-up was not counted.

The test was started by command, and stopped at the expiration of two minutes. The boys had had some preliminary practices, so that they knew approximately how fast they could go to make a maximum score. The boy might stop to rest, and then go on, if he so desired.

Test 2, Unlimited Number of Sit-ups.—This test was administered in exactly the same manner as Test No. 1, with the following exception. A metronome for indicating the rhythm of one sit-up completed in two seconds was used.

Preliminary experimentation demonstrated that this rhythm of one sit-up every two seconds was entirely satisfactory to the boys and was not too fast.

Whenever any individual got "off" the count, and was unable to recapture the rhythm, he was stopped and the number of his sit-ups taken. If he stopped to rest, the test was terminated.

Test 3, Sit-up Strength Using the Martin-Breaking Method.—A mat was placed on the edge of a stage three feet high. The subject sat in a sitting position with another boy holding his ankles.

The harness was placed on the subject from behind by looping the web strap over one shoulder, placing it back through the handle of the dynamometer. The strap was then looped over the opposite shoulder, carried through the dynamometer and buckled. The other handle of the dynamometer was hooked into one pulley. The other pulley was attached to the floor.

The subject's arms were folded across his chest, the right hand gripping the left arm, and the left hand gripping the right arm. The body leaned to approximately an angle of 45° from the floor before the pull was applied. The pull was at right angles to the long axis of the trunk.

The experimenter pulled steadily on the rope, pulling back on the shoulders of the boy, until he "broke," or gave way to the pull. The

amount of force necessary to cause the break was automatically registered on the dynamometer.

One boy was appointed as a secretary and took down the best test result out of three attempts. All of the pulls were made by the individual in charge of administering the tests. No two tests were given on the same day. A period of one day's rest was given between tests.

Training Period.—A two-month training period was started after the tests had been administered the first time. The first week of the training period each boy was to complete as many sit-ups as he could in one minute each day using the two-second count to each sit-up, unless he was unable to continue for the full minute.

After the first week of training, the length of time was increased day by day until most of the boys were able to complete from 80 to 100 sit-ups without too much difficulty. There were a few boys who never reached this number of sit-ups. At no time after the second week were the boys permitted to do less than the full two minutes of sit-ups.

The second tests were administered in exactly the same manner as the first tests following the two-month training period.

GENERAL DESCRIPTION OF RESULTS

It was found that a small number of boys could do more sit-ups in two minutes, using their own count, than they could do with unlimited time, using the two-second count for each sit-up. This was probably due to the fact that in the two-minute sit-up period, when the boy became too fatigued to continue, he could rest a few seconds and then continue, if still within the two-minute limit.

Following the two months' training period, every boy was able to make a gain in the number of sit-ups he could do, both in the two-minute test and in the unlimited test. All boys, with the exception of one, made a gain in sit-up strength.

The average gain for all boys was a substantial one in each of the three tests. The boys who had the greatest sit-up strength (as measured by the Martin-Breaking Method) did not have the greatest number of sit-ups, either in the two-minute sit-up tests or in the unlimited time tests. Neither did the boys who had the least amount of strength (as measured by the Martin-Breaking Method) have the lowest scores in the two-minute tests or in the unlimited tests. All boys having scores for the unlimited time sit-up tests, however, were among the highest in the two-minute sit-up tests.

Four boys made exceptional gains in the unlimited sit-up test the second time. The four scores were: 785, 780, 772, 750. The boy having the highest score, 785, also had a score of 91 in the two-minute test. Ninety-one was the highest score for the two-minute test. The other three boys were all over 85 for the two-minute test the second

time. The accompanying three tables show the range of scores and standard deviation for each test both times the tests were given.

TABLE I

TWO-MINUTE AND UNLIMITED SIT-UPS

	Range of Scores			Standard
	High	Low	Mean	Deviation
2 Min. Test:				
1st time	86	36	65.37	12.376
2nd time	91	55	76.19	8.289
Unlimited Test:				
1st time	225	34	99.89	50.566
2nd time	785	53	220.74	179.643
(with 700 + cases)				
2nd time	304	53	166.35	60.5
(without 700 + cases)				

TABLE II

SIT-UP STRENGTH AND WEIGHT

	Range of Scores			Standard
	High	Low	Mean	Deviation
Sit-up Strength (#lbs.):				
1st time	160	85	112.72	14.878
2nd time	190	95	126.70	20.583
(with 700 + cases)				
2nd time	190	95	128.4	20.93
(without 700 + cases)				
Weight	198	103.5	143.79	20.035

TABLE III

AMOUNT OF IMPROVEMENT BETWEEN FIRST AND SECOND TESTS FOR 2' SIT-UPS AND UNLIMITED SIT-UPS

	Range of Scores		
	Greatest	Smallest	Average
2' Sit ups	29	0	12.17
Unlimited	590	2	116.45
(with 700 + cases)			
(without 700 + cases)	260	2	76.09

ANALYSIS OF DATA

Because of the results of the studies which have been made on chinning and dipping by McCloy[3] and Krieser,[2] the experimenter, in this study of sit-ups, expected to find a substantial relationship with strength and weight. In the analysis of the sit-up data, this did not prove to be true to a significant degree, especially after practice.

In Tables IV and V it will be seen that the correlations with strength and weight, and the multiple correlations with strength and weight were not high enough for predictive purposes, *especially after practice.*

TABLE IV

CORRELATIONS WITH STRENGTH AND WEIGHT

	Strength 1st Time	*Strength 2nd Time*	*Weight 1st Time*	*Weight 2nd Time*
2′ Sit-Ups:				
1st time	.4494		.0219	
2nd time		.2831		—.0302
Unlimited Sit-Ups:				
1st time	.1191		—.0603	
2nd time		—.1805		—.1545

TABLE V

MULTIPLE CORRELATIONS WITH STRENGTH AND WEIGHT

2′ Sit-Ups:		*Unlimited Sit-ups:*	
1st time	.5030	1st time	.1720
2nd time	.3860	2nd time	(too curvilinear for multiple correlation)
		(with 700 + cases)	
		(without 700 + cases)	.3156

The effects of body build were then studied to see if this might be an important factor in the results obtained in the sit-up tests.

Evidently body build did not have a real, important bearing on sit-ups as a test of strength and endurance, as shown in Table VI.

TABLE VI

CORRELATION OF INDICES OF BODY BUILD WITH SIT-UP SCORES

		2′ Sit-ups 1st time	*Unlimited Sit-ups 1st time*
Chest Girth Height	Against	.0930	—.0082
Chest Girth Sitting Height	Against	.1505	.0649
$\frac{\text{Weight}}{\sqrt[3]{\text{height}}}$	Against	.1071	.1651

The next step in the analysis was to study the phenomena of improvement between the two administrations of the tests, shown in Table VII.

TABLE VII

ANALYSIS OF IMPROVEMENT BETWEEN THE TWO ADMINISTRATIONS OF THE TWO-MINUTE SIT-UP TESTS AND THE STRENGTH TESTS

Tests	*Coefficients of Correlation*
2′ (II) — 2′ (I) and Strength (I)	—.5010
2′ (II) — 2′ (I) and Strength (II)	—.3609
Strength (II) — Strength (I) and 2′ improvement	—.0903
Strength (I) and Strength (II)	.8750

Here the results are obvious in that those who were weaker to begin with improved the most in sit-ups, but not in sit-up strength as computed from the regression equation (Strength II = 1.238,

Strengt I — 11.59). The average strength of the lowest group on the first test improved 9.3% while the upper group improved 16.8%.

The regression equations were computed for the correlations:

Estimated 2′ Sit-ups (I) Against Actual 2′ Sit-ups (I) r = .4795
(Equation: Est. S.U. (I) = .455 (Strength I) —.1381 (weight) + 33.98)
Estimated 2′ Sit-ups (II) Against Actual 2′ Sit-ups (II)
(Using formula for predicting 2′ Sit-ups (I) from strength and weight)
r = .292
(Equation: Est. S.U. (II) = .455 (Strength II) —.1381 (weight) + 33.98)

Here the regression line for the second time was almost exactly three sit-ups higher than for the first time. It would seem that this result must have been because of the endurance factor.

In the unlimited sit-ups, the multiple correlation to predict the sit-ups from strength and weight were so low that no attempt was made to compute the regressions: 1st time, .1238; 2nd time .1999.

In predicting sit-up strength from the number of sit-ups and weight, the multiple correlations were somewhat higher, but not high enough to be significant for purposes of prediction. The multiple correlations were:

2′ Sit-ups (1st time)	R = .6150
2′ Sit-ups (2nd time)	R = .3860
Unlimited (1st time)	R = .4714
Unlimited (2nd time) (without 700 + cases)	R = .4700

In view of the fall-off from the Two-Minute (1st time), it was felt that it would not be profitable to use the regression equation.

These were computed, however, and are:

2′ Sit-up (I) Strength = .527 (S.U.) + .320 (wt) + 35.32
2′ Sit-up (II) Strength = .488 (S.U.) + .348 (wt) + 39.43
Unlimited (I) Strength = .043 (S.U.) + .339 (wt) + 59.65
Unlimited (II) Strength = —.129 (S.U.) + .295 (wt) + 107.33

CONCLUSIONS

There did not appear to be any markedly significant relationships between sit-ups and strength and weight.

Body build evidently did not have any important bearing on the sit-ups as a test of strength and endurance.

After strength reached a certain level further improvement in the number of sit-ups was accompanied by no significant increases in strength.

The endurance factor appeared to improve more than did strength.

We may conclude that sit-ups measure a combination of strength and endurance or the "general fitness" or "general condition" of the abdominal and thigh-flexor muscles.

SUGGESTIONS FOR FURTHER STUDY

In future study, it would seem desirable to have the individuals participating in the study be made up of only those who have had very little or no recent sit-up training. This would provide a more uniform group with which to start the testing, which, in turn, should give a better basis for determining the results of training.

In addition, to throw further light on the problem, it should be profitable to train a separate experimental group in sitting up with progressively greater weights to determine the effects of added dosage on the development of both strength and endurance.

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Standardization of a Badminton Knowledge Test For College Women

By MARJORIE PHILLIPS
Indiana University
Bloomington, Indiana

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WITH the need for adequate measurement devices well recognized in the field of physical education this study was undertaken in order to provide one tool which would contribute towards the satisfaction of this need. The primary purpose of the study was to construct and standardize a badminton knowledge test* for college women which could be used in classes of varying instructional levels.

PROCEDURE AND STATISTICAL ANALYSIS

The first consideration in constructing the test was to establish its curricular validity. The techniques used for this purpose were analysis of the contents of courses of study and textbooks, followed by the judgment of competent persons.

Courses of study were used from the departments of physical education for women at the University of Wisconsin, Indiana University, and Lawrence College. The books used were those by Jackson and Swan,[6]** Fisher,[4] Edgren and Robinson,[3] Ketchum[7] and the *Badminton Guide* of the National Section on Women's Athletics.[1]

As a result of this analysis, the most commonly emphasized phases of badminton were selected and listed as possible objectives which would be taught in college physical education classes and which would be measured by a knowledge examination. It was attempted to make this list as complete as possible and to state the objectives clearly and definitely so that they could serve as guides in formulating the examination questions.

A questionnaire was constructed to be sent out to badminton experts in order that they might either approve or disapprove the objectives selected and add additional ones if they thought it necessary. As well as signifying their approval, they were asked to assign a percentage value to each objective, which would indicate what they believed its relative importance to be. That is, if an objective were

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This article is a report of selected sections of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the University of Wisconsin, 1945.

* The completed test is not included with this article. Publication would lessen the value of the test, since it would then be available for study by students. Any qualified teacher may secure a key copy from the author. A charge of 25c will be made to cover cost of postage and mimeographing.

** Numbers refer to the bibliography at the end of the article.

assigned 10% it would mean that ten per cent of the questions should be concerned with that particular phase of badminton. The objectives selected were: a knowledge of the rules of badminton, the fundamentals of strokes, the strategy of singles and doubles play, bird flights and returns, the care and selection of equipment, badminton terms, and history of the game.

The questionnaire also included a list of books on badminton taken from the Cumulative Book Index. [10] [11] The judges were asked to rate these books from 1 to 5 according to their preference.

All the individuals selected as experts were teachers of badminton in college or university departments of physical education. Six of them were members or former members of the badminton subcommittee of the National Section on Women's Athletics of the American Association for Health, Physical Education, and Recreation, and the other eight were members of the American Badminton Association. These people were not selected particularly for their badminton skill or playing ability, but for their knowledge of education and physical education principles, course content at the college level, and because of their thorough acquaintanceship with the game of badminton.

Although the judgment of five or seven experts is usually considered acceptable, the questionnaire, in order to insure adequate judgment, was sent to fourteen experts.

All fourteen questionnaires were returned completely filled out. Table I contains a summary of percentages assigned to each objective by the judges and the average percent for each objective. All the objectives received sufficient approval to indicate that they should be included as guides in formulating questions for the badminton test. Additional objectives were mentioned by only one judge and as they represented only .5% of the total percentages assigned, they were not included. The five books chosen by the judges as being the best badminton texts were those by Jackson and Swan,[6] Devlin, [2] the Badminton Guide,[1] Edgren and Robinson, [3] and Fisher.[4]

In order to determine the reliability of the average ratings assigned by the fourteen judges to each objective, the correlation was found between the average estimates of the fourteen judges and the averages to be expected from an infinite number of judges. This correlation was found to be .940, which would indicate a fairly high degree of reliability for the percentages assigned to each of the objectives. The formula as developed by Peters and VanVoorhis*** was used for this purpose.

Except for questions on rules *Better Badminton* by Jackson and Swan[6] was used as the basic text for selecting the test material. This book was rated first by nine of the judges and second or third by four of the others. All material on rules was taken from the *Official Bad-*

*** Peters and Van Voorhis, pp. 195-199.

TABLE I

PERCENTAGES ASSIGNED TO EACH OBJECTIVE BY FOURTEEN EXPERTS

Judges	*Objectives*								
	A	B	C	D	E	F	G	H	I
1	25	33	15	20	2	2	2	1	—
2	20	60	5	5	—	5	5	—	—
3	65	—	10	10	3	5	5	2	—
4	25	25	20	20	—	—	10	—	—
5	20	34	8	10	3	5	8	5	7
6	30	40	5	5	5	5	5	5	—
7	10	30	15	15	5	15	5	5	—
8	35	63	—	—	—	—	—	2	—
9	25	45	—	10	2	10	3	5	—
10	25	25	10	10	10	10	5	5	—
11	50	—	10	10	5	10	10	5	—
12	40	40	5	5	1	1	6	2	—
13	50	19	5	5	2	1	10	8	—
14	50	20	6	6	2	10	4	2	—
Averages									
	34	31	8	9	3	6	6	3	.5

A	Rules
B	Fundamentals of strokes
C	Strategy of singles
D	Strategy of doubles
E	Care and selection of equipment
F	Flights and returns
G	Terminology
H	History
I	Additional objectives

minton Guide of the National Section on Women's Athletics,[1] which contains the laws of badminton as adopted by the International Badminton Federation.

Each rule and statement of information was written on a separate index card, exactly as it appeared in the source, and the name and page of the source were recorded. All statements were substantiated by at least one of the other authors and no point which was controversial among any of the five texts was included.

After a complete analysis of the texts had been made the information on each index card was examined in order to determine which form of objective-type question seemed most suitable. It was found that the true-false and multiple-choice forms seemed to best fit the information to be tested. The index cards were then arranged into two groups according to whether their information was most easily adapted to the true-false or multiple-choice question. There were 124 cards containing information to be made into true-false questions. These cards were carefully shuffled and then cards were drawn at random in order to make questions into true and false statements. The cards were drawn at random so as to insure that there would be no particular sequence of true and false answers. There were 54 cards containing information which would be made into multiple-choice questions. Again, in order to insure that there would be no particular sequence of right answers, the cards were shuffled and then drawn at random in order to assign positions to the correct answers among the five choices.

Both groups of index cards were then arranged according to the difficulty of the information. This arrangement was necessarily made by subjective judgment and a rearrangement would be made after the examination had been administered. An analysis of the questions revealed that approximately 34% were on rules, 28% on fundamentals

of strokes, 8% on the strategy of singles play, 12% on the strategy of doubles play, 2% on the care and selection of equipment, 6% on flights and returns, 7% on terminology, and 3% on history.

The test questions and directions to examinees were put in mimeographed form and the test appraised in terms of its physical and technical makeup, language usage, and selection of subject material.

At the top of the examination, space was provided for the examinee to write her name, college, date, and to tell the number of periods of instruction she had had in badminton, and to check whether or not she was a physical education major. This information was to be used in evaluating the results following the administration of the tests.

Nine hundred and fifty-five copies of the test were sent to physical education teachers in seventeen colleges and universities who had signified their willingness to participate in the study. Accompanying each set of tests were directions for administering, a key copy of the test, a letter of explanation and appreciation, and postage to cover the return mailing of the tests. Each instructor was asked to give her reactions to the test and to include any student comments concerning questions which may have seemed ambiguous, etc.

Six hundred and forty-eight completed tests were returned with all seventeen colleges and universities contributing. On the basis of these returns a complete evaluation was made. The purpose of this evaluation was to reduce the number of questions so that the test would be economical to administer and at the same time retain questions which would yield an optimum validity, reliability, and difficulty.

The reliability of the original test was found to be .879 when true-false items were not corrected for guessing and .929 when true-false items were corrected for guessing. The average amount of instruction received by the 659 people who took the examination was sixteen weeks or thirty-two periods. The range was from five weeks to thirty weeks, or ten to sixty periods. This means that there should have been a wide range in knowledge among those who took the test, if amount of instruction can be associated with knowledge. That this wide range was present is indicated by the range of test scores which run from 17 to 137 when true-false items are corrected for guessing. The mean score was 71.4 with a standard deviation of 23.8. All 659 tests were written by girls in the regular undergraduate classes, with no physical education majors among them.

There were two factors to be considered in establishing the number of questions to be included in the revised examination. First, the amount of time examinees would have for answering, and second, the number of questions which could be comfortably answered by the majority of students in that time. The time of the average instructional period at the college level is fairly standard at fifty minutes, so the problem reduced itself to the number of questions which could be answered in this time.

As 100 questions is a satisfying number from the standpoint of scoring and interpretation, a preliminary experiment was made in three college physical education classes with sixty-seven students in order to determine how long it would take the average student to answer an examination of that length. The examination consisted of fifty multiple-choice and fifty true-false questions on badminton. It was found that the average time needed was 40 minutes with a standard deviation of 5.8 minutes. As this meant that approximately 97.5% of the students could finish in 51.6 minutes, it was decided to reduce the examination to 100 questions.

The difficulty of each question was found by figuring the percentage of persons answering each question correctly. The validity of each question was established by two methods. The first method used was the difference between means,* in which the mean test score of all examinees answering the question correctly is subtracted from the mean test score of all those answering the question incorrectly. Thus, if the question is differentiating between the good and poor students, the mean score of those answering correctly should be considerably higher than the mean score of those answering incorrectly. In order to determine whether or not this difference is a significant one and that a question actually is differentiating between the good and poor students, it would be necessary to find the critical ratio of the difference between means for each question. However, as this would be an extremely laborious and time-consuming task, critical ratios were figured only for the smallest "difference" at each level of difficulty for the questions which appear in the final test. These critical ratios are given in Table II.

TABLE II

CRITICAL RATIOS OF THE SMALLEST DIFFERENCE BETWEEN MEANS AT EACH LEVEL OF DIFFICULTY

Questions O.T.	R.T.	%D	Mr	Mw	M.D.	C.R.
T.F. 42	1	92.8	73.9	57.0	16.9	5.5
T.F. 117	2	83.9	74.3	61.1	13.2	5.7
T.F. 36	7	75.4	75.4	62.2	13.2	6.7
M.C. 45	13	65.1	74.4	65.4	9.0	4.2
T.F. 29	17	59.6	75.8	66.8	9.0	4.8
T.F. 77	34	47.2	76.6	67.4	9.2	5.1

O.T. Number of question on original test.
R.T. Number of question on revised test.
%D Percent difficulty, percentage answering question correctly.
Mr Mean score of those answering the question correctly.
Mw Mean score of those answering the question incorrectly.
M.D. Difference between means.
C.R. Critical ratio of difference between means.

T.F. 81	44	37.0	78.9	68.1	10.8	5.5
T.F. 105	49	24.8	79.6	68.7	10.9	4.7
M.C. 53	45	14.2	80.9	69.7	11.2	3.8
T.F. 87	55	7.3	84.5	70.3	14.2	3.8

As a further check on the validity of the items, a second method of determining question validity was applied. This is a graphical method in which the Votaw Curve is used.[12] In this method all examinees were divided into two groups, the upper and lower. The upper group consisted of those individuals whose test scores were above the mean test score, and the lower group included those whose test scores were below the mean.

The proportion of each of these groups answering each question correctly was then calculated. It is now necessary to determine for each question whether the difference between these two proportions is due to chance. As a difference of three times the probable error insures a probability of about twenty to one that the difference was not due to chance, and as most test makers are satisfied with that criterion, it is the difference that was accepted in validating the questions. By this method the actual number of probable errors between the two proportions is not found, but it is assured that this difference will be at least three times the probable error.

Using the formula developed by Votaw,[12]* the proportions which would insure this difference were found and are given in Table III.

TABLE III

P_1 AND P_2 VALUES FOR MULTIPLE-CHOICE AND TRUE-FALSE QUESTIONS

Multiple-Choice k 3 N 274		*True-False* k 3 N 324	
P_2	P_1	P_2	P_1
.0	.014	.0	.012
.1	.157	.1	.152
.2	.273	.2	.267
.3	.381	.3	.372
.4	.485	.4	.478
.5	.586	.5	.579
.6	.682	.6	.676
.7	.776	.7	.770
.8	.864	.8	.859
.9	.946	.9	.942
1.0	1.0	1.0	1.0

P_1—proportion of upper group answering question correctly.
P_2—proportion of lower group answering question correctly.

The P_1 and P_2 values for the multiple-choice and true-false questions were plotted and the curves drawn. It is now possible, by using the actual proportions of each group answering each question correctly, to refer to the curve and determine the validity or invalidity of each question. The curves for multiple-choice and true-false questions differ

* Votaw, p. 684.

slightly due to the fact that 548 tests were used in analyzing the multiple-choice questions and 648 were used for the true-false questions. The curves are shown in Figures 1 and 2.

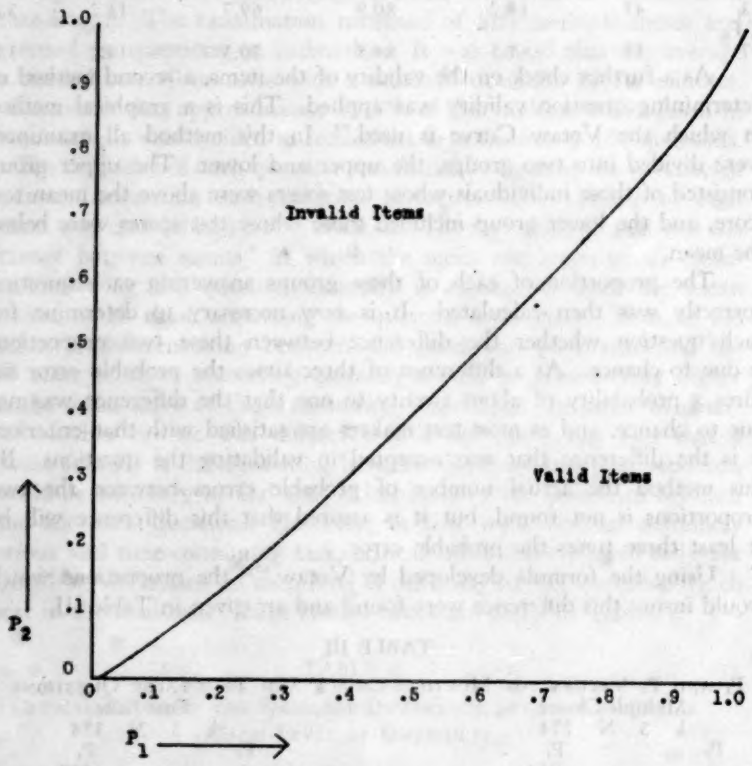

Fig. 1. Votaw Curve. Multiple-choice questions. K is 3 P.E. N is 274.

On the basis of these data the questions for the final test were selected. The first criterion for selection was the validity of the item. Any item whose difference between means was low or which, when graphed, fell on the invalid side of the Votaw Curve was automatically eliminated. The second criterion was the percentage assigned to each objective by the judges and the third criterion the difficulty of the question. All the valid questions were classified according to objectives and each objective considered separately, in order to retain the proper percentage of questions on each objective. Since there were many more true-false questions than multiple-choice on the first examination, in any case where a true-false and a multiple-choice question with approximately the same validity and difficulty were concerned with the same objective, the multiple-choice question was given preference. In this way

the relative number of true-false and multiple-choice questions appearing in the revised test was more equalized.

The questions on the revised examination were, then, chosen be-

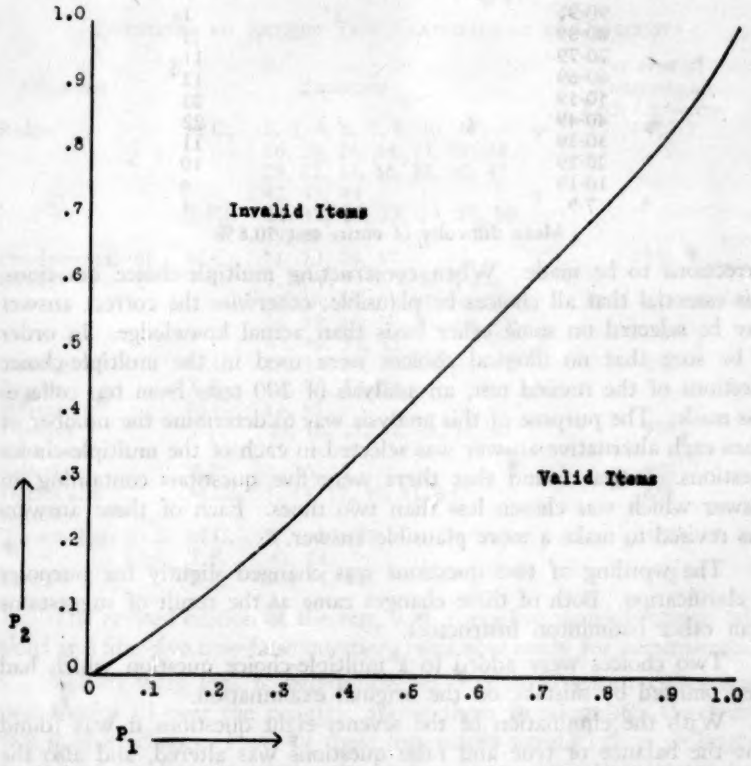

Fig. 2. Votaw Curve. True-false questions. K is 3 P. E. N is 323.

cause they were valid, because they assured curricular validity to the test by covering the objectives as assigned by the fourteen judges, because they gave a wide range of difficulty to the test, because they gave the entire test a difficulty of approximately 50%, and because they equalized the number of true-false and multiple-choice questions.

The 100 questions selected were rearranged in order of difficulty and renumbered. Difficulty and validity ratings for these questions are given in Tables VII and VIII (see end of article). By referring the P_1 and P_2 values given in Tables VII and VIII to the Votaw curves given in Figures 1 and 2, the relative validity of each question can be checked. Table IV gives the number of questions in the entire test at each level of difficulty.

After selecting questions for the revised test there were still a few

TABLE IV

DIFFICULTY SCALE OF REVISED TEST

Percent Level of Difficulty	*Number of Questions at each Level*
90-93	1
80-89	5
70-79	11
60-69	12
50-59	23
40-49	22
30-39	11
20-29	10
10-19	4
7-9	1

Mean difficulty of entire test 50.8%

corrections to be made. When constructing multiple-choice questions, it is essential that all choices be plausible; otherwise the correct answer may be selected on some other basis than actual knowledge. In order to be sure that no illogical choices were used in the multiple-choice questions of the revised test, an analysis of 200 tests from ten colleges was made. The purpose of this analysis was to determine the number of times each alternative answer was selected in each of the multiple-choice questions. It was found that there were five questions containing an answer which was chosen less than two times. Each of these answers was revised to make a more plausible answer.

The wording of two questions was changed slightly for purposes of clarification. Both of these changes came as the result of suggestions from other badminton instructors.

Two choices were added to a multiple-choice question which had been omitted by mistake on the original examination.

With the elimination of the seventy-eight questions it was found that the balance of true and false questions was altered, and also the balance of A, B, C, D, and E choices among the multiple-choice questions. In order to restore this balance, necessary rearrangements were made.

As a final check on the revised test an analysis of its contents was made in order to discover if a fairly adequate sampling had been made of the material under each objective. Table V lists the questions covering each objective and gives the percentage of questions assigned to each objective.

As a result of this analysis it was concluded that within the limitations imposed by the length of the test and the percentage of questions under each objective, an adequate sampling of the material was made in the revised test.

At the top of the revised examination a space was provided for examinees to indicate the total amount of badminton instruction they had received. They were requested to state the number of periods of

college instruction and the length of each period and the number of periods of instruction before coming to college. This information was to be used in setting up norms at different levels of instruction.

TABLE V

QUESTIONS ON REVISED TEST CLASSIFIED AS TO OBJECTIVES

Objective		*Questions*	*Per cent of Questions on Each Objective*
Rules	M.C.	1, 3, 4, 6, 7, 8, 10, 15, 16, 20, 23, 24, 25, 27, 28 29, 32, 35, 36, 38, 40, 41 42, 43, 44	34%
	T.F.	11, 17, 20, 23, 24, 28, 30 39, 50	
Fundamentals of Strokes	M.C.	11, 22, 26, 37	31%
	T.F.	1, 3, 4, 5, 6, 7, 8, 9, 12, 15, 18, 19, 21, 25, 26, 29 34, 35, 36, 37, 41, 44, 46, 47, 49, 51, 55	
Strategy of Singles	M.C.	18, 21, 30, 39	8%
	T.F.	22, 40, 52, 53	
Strategy of Doubles	M.C.	13, 45	9%
	T.F.	14, 16, 27, 31, 32, 38, 43	
Care and Selection	T.F.	2, 10, 13	3%
Flights and Returns	M.C.	5, 14, 17, 19, 31, 34	6%
Terminology	M.C.	2, 9, 12, 33	6%
	T.F.	42, 54	
History	T.F.	33, 45, 48	3%

The revised edition of the test, with forty-five multiple-choice questions and fifty-five true-false questions, was now ready for administration.

Letters were sent to badminton teachers in fifty-four colleges and universities all over the country, asking them to administer the revised test in their classes. Forty of these instructors signified their willingness to cooperate. Examinations were sent to them along with instructions for administering, a key copy of the test, and postage to cover return mailing. A total of 2,000 tests was sent to the forty colleges and universities and a total of 1,471 completed tests was returned from thirty of them.

It had been found that the reliability of the original test was raised from .879 to .929 when true-false items were corrected for guessing, so all of the revised test papers were scored both ways (corrected for guessing and not corrected for guessing) and it was found that the reliability of the revised test was raised from .863 to .921 when true-false items were corrected for guessing. This seems to offer fairly conclusive evidence that correcting true-false items for guessing is a desirable procedure on this test. On the basis of this evidence the scoring system adopted is multiple-choice questions right plus true-false questions right minus true-false questions wrong equals final score.

Now that all test papers had been scored, an analysis was made of the information at the top of each paper, so that examinees could be grouped according to the amount of instruction they had received. It was found that the length of the daily instructional period was fairly standard at thirty-five minutes, the regular fifty-minute period being reduced fifteen minutes for purposes of dressing and showering. The number of periods of instruction, however, varied widely from as few as eight periods to as many as fifty-five, although the number of cases at these extremes was small. It was found that the tests, according to amount of instruction, tended to fall into two large groups. Instructional periods of the first group were mainly from twelve to sixteen periods and the second group from twenty-five to thirty-six periods and so all tests were divided into two groups on this basis. For purposes of clarification the first group will be called beginners and the second group intermediates.

The average amount of instruction for beginners is fourteen 35-minute periods, with a range of eight to sixteen periods. The average amount of instruction for intermediates is thirty-one 35-minute periods, with a range of seventeen to fifty-five periods. Beginning test papers were sent from twenty-three colleges and universities and twenty-six sent intermediate papers. It would have been much more satisfactory if the amount of instruction could have been more standarized for the two groups, but this seemed to be the best possible classification with the data at hand. A small group of 109 major students in physical education from three colleges also took the test.

Percentile scores and T scores for the two groups, beginners and intermediates, are given in Tables IX and X (see end of article).

Mean scores, standard deviations, and reliabilities were found for everyone taking the test, and for each of the groups, these are given in Table VI. All reliabilities were found by the Kuder-Richardson method as adapted by Froelich.*

The advantage of this method is that all test scores can be included in the correlation without involving the tremendous amount of labor which would be required by the split-halves technique and Spearman-Brown formula. The formula is based upon the assumption that all the test items have the same difficulty, although experimental evidence** shows that even though items be of varied difficulty the method yields approximately the same indices as the split halves method, always, however, somewhat lower.

TABLE VI

MEANS, STANDARD DEVIATIONS, AND RELIABILITIES

	N	Range	M	m	dist.	r	P.E.
All Groups	1471	−1–93	39.2	.435	16.5	.921	± .0027
Beginners	694	−1–75	34.1	.490	12.9	.873	± .0061
Intermediates	668	4–87	40.7	.596	15.4	.907	± .0046
Majors	109	30–93	63.0	1.27	13.2	.874	± .015

* Froelich, pp. 384-385.

The critical ratios of the difference between the mean scores of beginners and intermediates and between the mean scores of intermediates and major students were found. These differences are 8.5 and 15.9 resepectively.

SUMMARY

The badminton knowledge test for college women has been found to satisfy the criteria of a good test. All items have been shown to be highly valid by both the Votaw Curve and difference-between-means methods. The smallest critical ratio of the difference between means for any question appearing on the revised test is 3.8 giving absolute assurance that the difference truly exists. The number of questions concerned with each objective agrees perfectly with the percentages assigned by the fourteen judges; thus curricular validity is satisfied. The difficulty range of the test is from 7% to 93% with a mean difficulty for the entire test of 50.8%. The reliability for a heterogeneous group was found to be .921, with the lowest reliability among three homogenous groups .873. Technical makeup and structure of individual questions satisfy approved criteria for test construction. Due to the type of question the test possesses complete objectivity. It is easily administerable during one class period and can be corrected with a minimum of effort and time by use of a key copy. Norms in terms of T scores and percentile ranks have been established for both beginners and intermediates.

CONCLUSIONS

1. The badminton knowledge test for college women is valid, reliable, objective, and economical to administer.
2. Since the test differentiates between different levels of ability it may be used to evaluate knowledge at any instructional level and also would be suitable to use in conjunction with skill tests for purposes of classification.
3. By use of norms established, class and individual comparisons of scores may be made, enabling students to evaluate their own progress. Norms also assist teachers in appraisal of the quality of their teaching as compared to that of other college teachers.
4. The test is sufficiently valid and reliable to afford confidence in the measurement of individual as well as group status and progress.
5. The method of scoring which yields the highest reliability is multiple-choice questions right plus true-false questions right minus true-false questions wrong equals final score.
6. Procedures followed in the construction of this test may serve as a guide to other investigators who wish to formulate objective, written examinations in physical education activities.
7. Investigators wishing to validate individual test items should, if choosing between the two methods used on the badminton test, select the

Votaw Curve since both methods are approximately equal in discriminatory power and the Votaw Curve requires less computation and is more appealing because of its graphical nature.

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TABLE VII

DIFFICULTY AND VALIDITY RATINGS FOR MULTIPLE-CHOICE QUESTIONS ON REVISED TEST

Question R.T	O.T	%D.	M.D.	P_1	P_2
1	44	86.3	16.0	.923	.800
2	35	83.8	15.9	.910	.764
3	4	82.8	15.2	.898	.755
4	21	80.0	15.2	.890	.713
5	33	78.7	19.8	.883	.680
6	5	76.1	16.7	.854	.661
7	23	74.7	17.8	.874	.617
8	14	74.0	15.6	.862	.615
9	8	71.3	17.9	.840	.585
10	18	68.7	15.9	.792	.576
11	15	68.6	12.8	.793	.576
12	11	68.5	12.6	.749	.613
13	45	65.1	9.0	.720	.584
14	34	64.4	12.7	.767	.578
15	46	60.3	16.7	.716	.483
16	13	55.8	20.4	.746	.361

R.T. Number of question on revised test
O.T. Number of question on original test.
%D Per cent of people answering question correctly.
M.D. Difference between means of those answering question correctly and those answering the question incorrectly.
P_1 Proportion of upper group answering question correctly.
P_2 Proportion of lower group answering question correctly.

17	31	54.0	18.8	.687	.396
18	32	53.9	19.7	.709	.381
19	37	53.2	18.5	.687	.374
20	40	52.8	13.2	.658	.392
21	26	52.4	16.6	.654	.396
22	16	51.6	13.9	.644	.389
23	9	51.1	16.0	.669	.360
24	20	50.8	17.5	.676	.339
25	2	50.0	14.2	.631	.368
26	38	47.7	10.0	.568	.385
27	3	43.4	18.8	.590	.284
28	51	42.0	15.7	.560	.287
29	17	41.5	12.3	.514	.316
30	36	41.5	14.0	.512	.305
31	30	41.3	17.1	.556	.261
32	52	39.7	14.2	.516	.280
33	7	38.5	15.3	.503	.261
34	29	37.1	12.9	.465	.276
35	48	36.9	22.4	.549	.189
36	54	36.8	13.1	.458	.280
37	39	35.6	15.1	.458	.240
38	22	33.6	20.1	.479	.190
39	28	31.2	10.9	.392	.232
40	25	30.7	16.5	.433	.184
41	50	29.6	20.7	.429	.160
42	43	25.1	12.5	.305	.197
43	41	23.7	12.8	.324	.148
44	49	17.4	18.7	.318	.118
45	53	14.2	11.2	.177	.104

TABLE VIII

DIFFICULTY AND VALIDITY RATINGS FOR TRUE-FALSE ITEMS ON REVISED TEST

Question R.T	O.T	%D.	M.D.	P_1	P_2
1	42	92.8	16.9	.959	.882
2	117	83.9	13.2	.888	.798
3	71	77.5	16.1	.851	.702
4	76	76.2	13.5	.857	.671
5	62	76.1	15.3	.842	.665
6	70	75.6	15.9	.857	.659
7	36	74.4	13.2	.860	.650
8	113	70.5	17.8	.851	.557
9	66	69.8	21.7	.879	.517
10	119	69.7	9.4	.761	.631
11	10	67.5	15.7	.786	.554
12	67	67.0	13.4	.780	.554
13	116	65.8	10.0	.721	.579
14	59	61.0	15.6	.724	.488
15	40	59.7	9.8	.653	.544
16	94	59.7	15.5	.733	.464
17	29	59.6	9.0	.693	.507
18	80	58.6	10.7	.667	.492
19	32	57.9	9.6	.650	.517
20	17	57.1	18.9	.736	.405
21	73	57.0	13.0	.709	.430
22	53	54.0	18.0	.690	.383
23	30	51.9	14.0	.634	.408
24	23	51.6	12.8	.622	.408
25	83	50.7	17.7	.668	.349
26	58	50.4	12.3	.594	.408

27	61	50.2	11.4	.585	.421
28	9	49.6	14.8	.616	.374
29	117	49.0	11.5	.588	.387
30	6	48.9	13.2	.606	.365
31	90	48.7	12.7	.582	.390
32	103	48.5	10.7	.560	.402
33	122	47.3	12.9	.582	.396
34	77	47.2	9.2	.557	.402
35	96	46.8	12.3	.582	.359
36	43	46.6	14.5	.600	.325
37	114	46.3	15.1	.597	.325
38	93	45.5	15.8	.582	.322
39	12	45.0	13.0	.560	.346
40	54	44.7	14.7	.690	.383
41	110	43.3	10.8	.583	.315
42	97	41.4	22.7	.613	.216
43	92	40.1	18.2	.758	.430
44	81	37.0	10.8	.445	.297
45	120	34.8	19.5	.489	.201
46	74	28.9	16.9	.399	.173
47	49	26.5	11.4	.331	.201
48	124	26.5	21.7	.396	.126
49	105	24.8	10.9	.312	.179
50	20	24.5	13.5	.325	.164
51	50	22.9	17.8	.331	.131
52	63	21.3	15.7	.294	.130
53	106	15.1	15.9	.207	.083
54	46	15.0	16.7	.223	.077
55	87	7.3	14.2	.102	.040

TABLE IX

BADMINTON KNOWLEDGE TEST FOR COLLEGE WOMEN
NORMS FOR BEGINNERS

N 694

Raw Scores	*PR**	*TS***	*Raw Scores*	*PR*	*TS*
74	100	81	36	59	52
73	100	80	35	57	51
72	100	79	34	55	50
71	100	78	33	51	49
70	100	78	32	49	48
69	99	77	31	45	48
68	99	76	30	42	47
67	99	75	29	38	46
66	99	75	28	35	45
65	98	74	27	33	44
64	98	73	26	30	44
63	98	72	25	27	43
62	98	72	24	23	42
61	97	71	23	21	41
60	97	70	22	19	41
59	97	69	21	17	40
58	97	69	20	14	39
57	97	68	19	12	38
56	96	67	18	10	37
55	95	66	17	9	37
54	94	65	16	8	36
53	94	65	15	8	35
52	93	64	14	7	34
51	92	63	13	6	34

* PR Percentile Rank.
**TS T Score.

50	91	62	12	5	33
49	89	61	11	4	32
48	88	61	10	3	31
47	85	60	9	2	31
46	84	59	8	1	30
45	82	58	7	1	29
44	80	58	6	1	28
43	78	57	5	0	27
42	76	56	4	0	27
41	74	55	3	0	26
40	72	55	2	0	25
39	69	54	1	0	24
38	66	53	0	0	24
37	63	52	—1	0	23

TABLE X

BADMINTON KNOWLEDGE TEST FOR COLLEGE WOMEN
NORMS FOR INTERMEDIATES
N 688

Raw Scores	*PR**	*TS***	*Raw Scores*	*PR*	*TS*
86	100	80	44	60	52
85	100	80	43	59	52
84	100	79	42	57	51
83	100	78	41	54	50
82	100	78	40	52	50
81	99	77	39	50	49
80	99	76	38	47	48
79	99	76	37	44	48
78	99	75	36	42	47
77	99	74	35	39	46
76	99	74	34	36	46
75	98	73	33	33	45
74	98	72	32	30	44
73	98	72	31	27	44
72	98	71	30	25	43
71	98	70	29	22	42
70	97	70	28	20	42
69	97	69	27	18	41
68	97	68	26	16	40
67	96	68	25	15	40
66	96	67	24	14	39
65	95	66	23	11	38
64	95	66	22	9	38
63	94	65	21	8	37
62	93	64	20	7	36
61	92	64	19	6	36
60	91	63	18	5	35
59	90	62	17	3	34
58	88	62	16	3	34
57	87	61	15	3	33
56	85	60	14	2	32
55	83	60	13	2	32
54	81	59	12	2	31
53	80	58	11	1	30
52	77	58	10	1	30
51	76	57	9	1	29
50	73	56	8	1	28
49	70	56	7	1	28
48	68	55	6	0	27
47	66	54	5	0	26
46	65	54	4	0	26
45	63	53			

* PR Percentile Rank.
**TS. T Score.

Research Abstracts

Prepared by the

NATIONAL COUNCIL OF THE RESEARCH SECTION

ANATOMY AND PHYSIOLOGY

Elliott, Harry C. "Cross-Sectional Diameters and Areas of the Human Spinal Cord," *Anat. Rec.*, 93: 3.

In the absence of data in the literature, records were collected on the measurements of normal adult human spinal cords. Averages, maxima, and minima are presented for ninety-eight cases. Figures are very similar for four sub-groups from different sources and for the total. Total averages are: at maximum girth of cervical enlargement, 13.2 x 7 mm.; at minimum of thoracic region, 8.0 x 6.5; and at maximum of lumbo-sacral region, 9.6 x 8.0. Range of variation was very large, ± 25% of average. Artefact influences were shown to contribute little to this variation, for large coronal diameter was, in general, associated with a large sagittal, and a small with a small, so that distortion was ruled out. Experiment with strengths of fixative and length of fixation showed that these did not alter dimensions beyond the range of experimental error. Correlations of cord size with age, sex, etc., could not be made. —*The Wistar Institute.*

Grant, J. C. Boileau. "Anatomical Nomenclature," *Anat. Rec.*, 94: 1.

The composite view of Canadian anatomists on nomenclature. Terms of position and direction: dorsal, ventral, cranial, and caudal and their synonyms, posterior, anterior, superior, and inferior are recognized by and used by B.N.A. and B.R. Both sets of terms should be retained and used interchangeably. Names of structures: although B.N.A. is 50 years old, medical textbooks (and periodicals) still use pre-B.N.A. terms, *e.g.*, musculospiral nerve, supinator longus, scalenus anticus, astragalus, and adrenal gland. The vast body of medical practitioners should have some voice in the discussions on terminology. Both B.N.A. and B.R. terms confront us; hence, we should be familiar with both. Further, both sets may be in use 50 years from now. It is desirable, as soon as possible, to have a working agreement on terminology between English-speaking anatomists.

Well established terms should not be changed lightly nor tinkered with on minor grounds of logic or etymology. Making trivial alterations in a term may be performing a service to philology, but it is performing a far greater disservice to the cause of anatomy.—*The Wistar Institute.*

Haxton, Herbert. "A Comparison of the Action of Extension of the Knee and Elbow Joints in Man," *Anat. Rec.*, 93: 3.

By the use of tensometers on cadaver limbs it has been found that in the knee and elbow joints the leverage of the action of the extensor muscles becomes greater as the joints are extended from the flexed positions. This increase of leverage is greater in the knee than in the elbow, and it extends over a greater range of the movement of the knee joint. The determining factor in the leverage of a muscle's action on a joint is the distance of its tendon from the joint axis. In the movement of extension this distance is increased more effectively in the knee joint by the action of the patella and by the excentric position of the joint axis than it is at the elbow joint by the projecting olecranon. The extensor mechanism at the knee has the advantage over that at the elbow in that it combines a greater leverage in the extended positions of the joint with greater strength of the bones such as is necessary for weight-bearing. There is a disadvantage in that there are greater frictional losses due to the patella.—*The Wistar Institute.*

Sunderland, Sydney. "The Innervation of the Flexor Digitorum Profundus and Lumbrical Muscles," *Anat. Rec.*, 93: 4.

From a study of suitable ulnar and median nerve lesions, it has been

established that the nerve supply of a lumbrical muscle is not necessarily the same as that of the fibres of the flexor digitorum profundus controlling the tendon and digit with which the lumbrical is associated, though in the majority of cases this arrangement obtains. The parts of the flexor mass supplied by the median and ulnar nerves and the relationships existing between them were also investigated and have been described.—*The Wistor Institute.*

EDUCATION

Campbell Roald F. "State School Board Association," *School and Society,* 62: 1609.

A national study was made of state school board associations. A total of 27 associations were found to exist in the United States. All but one were found to be operated under an adopted constitution and by-laws.

Twenty-two of the 27 associations reported activity in support of school legislation. Eight of the 27 publish journals for school board members. Twenty-six of the 27 hold annual meetings. It was concluded that other state school board associations should be founded, rural as well as city districts should belong, these associations can be a potent force in legislation, journals are an aid to school board members, and that the foundation of a national school board association should be considered.—*Carolyn Bookwalter.*

Young, Leontine R. "Personality Patterns in Unmarried Mothers," *The Family,* 26:8, (Dec., 1945).

One hundred cases from an unmarried mothers' agency were studied. There were found to be common elements in the backgrounds of the girls. None of them had happy, healthy relationships with their parents. The conflicting feelings of love and hate remained a basic and potent source of unhappiness and trouble.

Fifty-eight of the 100 had known mothers who controlled their lives and emotional development to an extent that could only result in damage to personality. The more dominating, sadistic, and rejecting the mother the sicker and more hopeless the girl. Dominating fathers were found to have a similar effect. All but 17 came from homes dominated by one parent.

None of the cases were free from self-punishment. Almost no girl cared for or made a pretense of caring for the baby's father. The girls seemed to consider the baby as a possible solution to their problems.—*Carolyn Bookwalter.*

NUTRITION

Eklund, Alice B., and Vera R. Goddard. "Stability of Thiamin Chloride in Mineral Vitamin Fortified Cereal," *Food Research;* 10: 5, Sept.-Oct., 1945).

Twelve commercial brands of cereals were tested for their pH values. The cereal found highest in pH value was selected for investigation. Cooked cereal was found to produce better results than raw cereal on the three groups of rats (85 in all). It was concluded that quick cooking of cereal caused no destruction of the added thiamin and possibly increased its availability to a slight extent.—*Carolyn Bookwalter.*

McLean, Dorothy S., Gladys K. Lewis, Elizabeth Jensen, Millicent L. Hathaway, Herta Breiter, and Julia O. Holmes. "Further Studies on the Calcium Requirements of Preschool Children," *Jr. Nutrition,* 31: 1.

Seven preschool boys were subjected to a 40-week experiment during which calcium balances at different levels of calcium intake were determined for the purpose of assessing requirements for calcium. The values representative of the daily needs of the newly formed skeletal tissues, are, in the order of increasing age of the subjcts, 150, 154, 137, 143, 148, 161, and 143 mg. On the basis of such retention and at the rate at which each subject could utilize milk calcium, the daily requirements for dietary calcium have been computed,

the resulting values being 843, 723, 685, 831, 1165, 826, and 803 mg., or 53, 44, 35, 50, 57, 37, and 40 mg. per kg. Assuming that children, under acceptable dietary conditions, could secure 300 mg. of calcium daily from the non-milk foods which they eat, and that such calcium is utilized to the same extent as is that of milk, the requirements of six of the boys would probably be met by a milk supplement greater than 2 cupfuls; one subject would have needed three-fourths of a quart.—*The Wistar Institute.*

Polskin, Louis J., Benjamin Dramer, and Albert E. Sobel. "Secretion of Vitamin D in Milks of Women Fed Fish Oil," *Jr. Nutrition,* 30: 6.

The vitamin D level in the milks of eighteen mothers who received no supplement of this factor was less than 10 I.U. per quart. Three cases had 17, 28, and 40 I.U. per quart.

The average vitamin D content per quart of milk of mothers supplied during the latter half of pregnancy was: (a) 10 I.U. for seven mothers given from 32,000 to 96,000 I.U. of supplement; (b) 53 I.U. for nine mothers given from 128,000 to 224,000 I.U. of supplement; (c) 62 I.U. for five mothers given from 256,000 to 320,000 I.U. of supplement; (d) 53 I.U. for six mothers given from 416,000 to 480,000 I.U. of supplement. Two mothers given a single dose of 32,000 I.U. during labor secreted milks which bioassayed 91 and 216 I.U. per quart. Seven women supplied 40,000 I.U. of vitamin D daily from labor to about 10 days and later yielded milks which averaged 310 I.U. vitamin D per quart (range 125 to 583 I.U.). It is concluded that for the purpose of fortifying human milk with vitamin D for infant use, supplementation of the mother with fish liver oil during pregnancy is not a practical method. Vitamin D must be taken just prior to or during lactation in order to enrich the milk with the factor appreciably. In an 8-day balance study, a patient secreted about 1.3% of the ingested vitamin D in the milk, 6.9% in the stools, and 36% in the blood samples.—*The Wistar Institute.*

PHYSICAL EDUCATION

Clarke, David L. "The Place of Volunteer Leaders' Clubs in the (YMCA's) Second Century," *Journal of Physical Education,* 42: 3 (Jan.-Feb., 1945). 3 (Jan.-Feb., 1945).

The importance of YMCA volunteer leadership during the Association's first hundred years is here evaluated and general principles laid down for future development. YMCA leaders' clubs have supplied recruits for professional careers in physical education. Regular weekly training is supplemented with intensive training institutes combining clubs from several cities. Service projects are analyzed and specialized training provided to equip specific group and sports leaders for their tasks. State and area resource materials and standards are being developed to supplement the National YMCA volunteer, leadership-training program.—*Harold T. Friermood.*

"Health and Physical Education for Boys," *Journal of Physical Education,* 42: 3 (Jan.-Feb., 1945).

Growing out of two national YMCA conferences held during the first half of 1944, a fresh emphasis on boys' health and fitness has emerged. This brief article is based on the *National Council Bulletin Wartime Program,* Supplement No. 10, in which the ten point program for boys is presented. Criteria of progress are: creation of a capable planning committee, a written policy, a graded and progressive program, provision for high grade leadership, both lay and professional, a leadership-training program for boys, health examinations with adequate follow-up, appropriate physical fitness testing twice a year with reports, use of National YMCA Aquatic Program so that all boys may be taught to swim, emphasis on total fitness, development of Christian character through planned and controlled situations under proper leadership.—*Harold T. Friermood.*

Kallenberg, Henry F. "The Second One Hundred Years," *Journal of Physical Education,* 42: 4 (March-April, 1945).

From the vantage point of more than half a century of intimate experience in and contact with physical education, Dr. Kallenberg surveys past strengths and weaknesses in YMCA physical education and makes specific proposals for the future. He emphasizes the need for straight thinking based on established principles. A study of the Association's form of organization which needs program specialists as well as program coordinators would help eliminate friction and misunderstanding. It is suggested that the YMCA make use of successful methods used in the armed forces, develop working relationships with the medical and kindred organizations, and that field groups keep in close touch with the two YMCA training schools relative to curricular needs in this field, that the YMCA swimming program be expanded, that areas and states develop two- to four-week intensive training courses in the nature of postgraduate courses at points of special need, that all inclusive conferences be held to integrate the best thinking in many related fields into the program, and that a tribunal or board of arbitrators be formed to aid in national policy formulation.—*Harold T. Friermood.*

Oberteuffer, Delbert. "Related Values," *Journal of Physical Education,* 42: 4, (March-April, 1945).

An analysis of physical training vs. physical education is made by Dr. Obertueffer, Delbert. "Related Values," *Journal of Physical Education,* 42: 4 teaching. This teaching should be directed toward securing significant associated learning because, "Virtues do not grow automatically from sports participation." Social behavior and group sanctions arise and are developed in specific situations. While strength, endurance, performing skill, and other physical factors should be developed by the physical educator, his job also involves the direction and education of attitudes, ideals, and emotions in socially desirable patterns.—*Harold T. Friermood.*

Strain, D. E. "Body Building with Weights," *Journal of Physical Education,* 42: 4 (March-April, 1945).

A body-building group in the Winnipeg YMCA, Manitoba, Canada, grew 20 to 127 members during a single season under the experienced leadership of a 53-year-old instructor. He spent two months impressing the importance of pressing 40 pounds ten times rather than 135 pounds once. Strength is built on the overload and repetition principle. Progression is planned for each individual. Starting with a weight that can be handled comfortably, the individual goes through each movement five times. The repetitions are gradually increased on practice nights until each movement is repeated ten times. Then the weight is increased and the five repetition cycle is started again. When a certain standard is attained according to the man's weight he is promoted to the intermediate group, where a different set of tables challenges his interest and ability, and so on into the advanced group. Some men take only a month to graduate into the next group; others, four to six months, but in the meantime, strong bodies are being built. Included in the development program are 18 beginner movements, 17 intermediate, and 20 advanced routines.—*Harold T. Friermood.*

PHYSICAL THERAPY

Carnes, E. A. "Something New in Electric Cabinet Baths," *Journal of Physical Education,* 42: 3 (Jan.-Feb., 1945).

A non-metal horizontal electric cabinet for use in hospitals, clinics, YMCA's, and some private homes has been developed and tested in the Oak Park, Illinois, YMCA. It is thoroughly insulated with rock wool. Economical to operate, it will hold an even temperature of 125 degrees with one-half of the lights turned off. It is so wired that one-half of the lights (50 watts to each cubic foot) can be turned off and yet keep equal distribution of heat and light above and below the patron. Used to induce relaxation along with general sweating. Use of the cabinet is followed by a shower bath and a general massage. Has proved beneficial for adult men.—*Harold T. Friermood.*

Book Review

Off the Job Living — A Modern Concept of Recreation and Its Place in the Postwar World. G. Ott Romney. New York: A. S. Barnes and Company, Inc., 1945. 232 pages, $2.75.

The book is timely in view of the current interest in the recreation movement. With his unique style, the author cleverly reveals his recreational philosophy. The book is replete with human interest accounts and illustrations which are likely to stimulate many a smile by the interested reader.

Throughout the book he develops the theme that recreation is "a personal response, a psychological reaction, an approach, a way of life." Recreation is justified as an "end unto itself" and not because of its therapeutic values or contributions to character development. It is not an "antidote for juvenile delinquency." Recreation is "fundamentally a community—a municipal—responsibility." The need for facilities and leadership as public recreation services is stressed.

The chapter, "Recreation Goes to War," presents an interesting account of the recreation services provided through the U. S. Army Special Services, U. S. Navy Recreation Services, United Seaman's Services, The United Service Organizations, Inc., American Red Cross, and communities. This chapter in particular has many examples of human interest which reveal clearly the magnitude of the contribution of recreation to the war effort.

The chapter, "Recreation in Specific Fields," includes a concise discussion of the place of recreation in industry, public housing, institutions for the handicapped, and correctional institutions.

The concluding chapter is titled "Where from Here?" Using the postwar agenda of the National Resources Planning Board, the author presents evidence that recreation now is "an accepted member of the family of social forces." The satisfaction of human hungers through recreation is "big enough for all the agencies and services of all kinds. The job needs all and more, if recreation is to reach all of the people."

The author, a recognized authority on recreation, has challenged society to fulfill its obligations to provide public recreation. The book is recommended to those engaged in recreation services and those who have ambitions to do so. For those educators who as yet have not appreciated the need for adequate "education for leisure" and more extensive use of school facilities for recreation and for those taxpayers disposed to oppose expansion of public recreation services it is especially recommended.

CARL L. NORDLY,
University of Minnesota,
Minneapolis, Minnesota.

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1 Katherine B. Crisp, *Health for You*, p. 520. (books)

2 Stern, Francis. *Applied Dietetics*. Baltimore: William and Wilkins Company, 1943. (books)

3 Corbin, H. D., "Current Problems in Recreation," *Journal of Health and Physical Education*, 15:6 (June, 1944), pp. 315-16, 353-54. (magazines)

4 Kraines, S. H., and E. S. Thetford. *Managing Your Mind*. New York: The Macmillan Company, 1944.

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